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CONFIDENTIAL      No. 1312

Not to be taken into front line trenches. Issued to include  
Platoon Commanders

Instructions for the  
Defensive Combat  
of Small Units

Infantry: Platoon to Regiment



*Adapted from*  
**FRENCH, BRITISH AND AMERICAN INSTRUCTIONS  
AND OTHER SOURCES**



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## PREFACE.

These Instructions are adapted from French, British and American Instructions and other sources. They are published for the information and guidance of the American Expeditionary Forces.

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GENERAL HEADQUARTERS AMERICAN EXPEDITIONARY FORCES.  
FRANCE, *July, 1918.*

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INSTRUCTIONS  
FOR THE  
DEFENSIVE COMBAT OF SMALL UNITS.  
(Infantry: Platoon to Regiment.)

INTRODUCTION.

1. These Instructions are adapted from French, British and American Instructions and other sources, and are based on experience in the most recent operations.
2. Chapters I and II, Part I, explain the general characteristics of offensive and defensive combat. A study of these characteristics is necessary for a clear understanding of the measures to be adopted by the defense and for the co-operation of the combined arms in defensive combat. The details of defensive combat are given in the chapters and parts which follow.
3. The employment of natural and artificial features of the ground and the improvement of same for increasing the power of the defense is an essential part of defensive combat. When troops understand how to properly employ these features they will be able to fight a defensive combat not only in an intrenched system but also along such natural and artificial features of the ground as may be found in open warfare. And furthermore they will know how to select a position and prepare it for defense. These Instructions have been written with that object in view.
4. An intrenched position furnishes a large number of natural and artificial features which may be employed for defensive combat. The plan of defense of a position assigns to a part of the elements of a unit a defensive mission (holding combat groups), and to the remainder an offensive mission (counter-attack). Holding an intrenched position furnishes an

opportunity therefore for instructing officers, non-commissioned officers and men not only in defensive combat but also in offensive combat. Explain to the officers and men the plan of defense, the purpose of the various works, their relative location, how they are employed, and correct at once any part of the works which does not fulfill its mission. Rotate the units assigned to front line, supports and reserves. Explain to units assigned to supports and reserves how the counter-attack should be conducted to meet various situations. Require officers and non-commissioned officers to solve tactical problems for counter-attack to meet other situations. Commanders of all units from the platoon to the highest must not fail to take advantage of the opportunities thus presented for instructing their officers and men. The proper defense of the position demands it.

## Part I.

### GENERAL PRINCIPLES.

#### *Chapter I.*

##### CHARACTERISTICS OF THE ATTACK.

1. The primary object of all combat is the subjugation, capture or destruction of the hostile armed forces, in order that a just peace may be forced upon the hostile government. Secondary objects may be the occupation of hostile territory in order to deprive the enemy of material, supplies and means of carrying on the war, or even possession of strategical or tactical points of importance, but these are only secondary to the main issue.

2. Whether combat consists in an engagement along lines well organized for a long period, in small engagements forming parts of a general battle or in a meeting engagement, this combat must finally culminate in some form of attack of a position. Combat may thus be divided into two general classes, the offensive and the defensive.

3. The offense *reconnoiters* and *develops* the defensive position (determines the location, composition, strength and dispositions of the forces of the defense), *selects the points and direction* for attacks and attempts to *close with the defense*, *overrun his position*, and *capture or destroy* the defenders by fire and by bayonet or the threat of the bayonet.

4. In trench warfare the reconnaissance and development of the hostile position is made by aeroplanes, observation balloons, raids, patrols, ground observers, etc., which collect information from day to day. In open warfare the reconnaissance and development of the defensive position may consist in driving back the outpost or covering detachments of the defense and uncovering their position, drawing their fire, and in reconnoitring by aeroplanes, observation balloons, patrols, ground observers, etc. Cavalry may be used.

5. Having determined the location, composition, strength and disposition of the forces of the defense, the offense selects the *point and direction* for attack. On a large front it may be

made against a section which is generally poorly organized, weakly held, with few reserves, etc., which invites capture. It is generally greatly influenced by strategical considerations. Locally the point and direction of attack is governed by tactical considerations. The main attacks may be made against weak points of the position, or up valleys or ravines under cover of fog or smoke, with a view to penetrating the position and taking strong points from the flanks or rear.

6. In order that the offense may close with the enemy it must gain fire superiority over the defense, or else under cover of fog, smoke, dust or darkness take the defenders by surprise. Against a well trained and properly organized defense surprise is impossible. In this case the attack must protect its troops during the advance by fire superiority. The offense attempts to gain this fire superiority:

(a) By a *preparatory bombardment* which has as its object the destruction or disorganization of important elements of the defense. The fire of artillery, trench mortars, one-pounders and machine guns is directed against important elements of the defense (obstacles, machine gun emplacements, artillery emplacements, points of resistance, dugouts, routes of communication, etc.). This bombardment may last several days. In recent large attacks it has lasted four or five hours, consisting of alternate periods of bombardment with gas or high explosive shells, or both. In local attacks, or when tanks are used to open gaps in the obstacles, or in open warfare before the artillery arrives, this preliminary bombardment may be omitted altogether.

(b) During the advance to attack, by artillery trench mortar and one-pounder bombardment directed against elements of the defense which have been located or suspected, and by an artillery and machine gun barrage (in trench warfare a timed creeping barrage which the infantry may follow at a distance of about 100 yards; in open warfare such close co-operation between the infantry and artillery cannot be expected). This is supplemented by machine guns, trench mortars, one-pounders, automatic rifles, rifles and sometimes by artillery using indirect (or even direct) fire which support or accompany the infantry and direct their fire against points of resistance which still hold out. Sections of the advance held up add their automatic and rifle fire to the above and support the advance of the remainder. Tanks may be employed to reinforce this fire and support the infantry. In open warfare, before much artillery and ammunition arrive, attempt may be made to gain fire superiority by use of automatic rifles and machine guns, some of which may be slowly worked well forward in advance of the infantry, and by trench mortars and one-pounders supporting or accompanying the advance, and by the automatic rifle and rifle fire of sections held up which support the advance.

of the remainder. In this, single pieces of artillery may be used which employ direct fire against points of resistance, machine guns, etc., of the defense.

7. The infantry is formed for the attack in depth. A division with three regiments may place two regiments in the front line and one in reserve; a division of four regiments, two in the front line and two in reserve. Regiments in the front line may place two battalions in the front line and one in reserve. Battalions in the front line may place two companies in the front line and two in reserve. (For formation of small units for attack see Offensive Combat of Small Units.)

8. Protected by such natural and artificial features of the ground as may be found, and by the fire mentioned in Par. 6 (b) above, these various echelons advance to the attack in successive waves. Each wave of the assault battalion usually has a strength of about one man per fire yards of front. Under cover of darkness or fog this density may be increased. When sections of the advance wave are held up by points of resistance of the defense, these sections are not reinforced for a frontal attack, but together with trench mortars, machine guns, one-pounders, and even artillery, they attempt to gain fire superiority over the remaining points of resistance of the defense and hold down their fire, while the remaining sections of the advance waves and the supports and reserves of the attack, closely following the barrage (if there be one), attempt to penetrate the position of the defense, and attack the points of resistance on the flanks and rear. The infantry of the attack is thus placed not only within assault position on the front of points of resistance of the defense, but also on their flanks and rear. The fight then becomes an infantry combat supported by trench mortars, one-pounders, and machine guns. Artillery support for a time is more or less uncertain.

9. Having arrived at the assault positions in front and on the flanks and rear of points of resistance of the defense, the attack attempts to capture or destroy the occupants of same by assault with the bayonet, or, having surrounded them, compel their surrender by cutting off their supplies and subjecting them to a heavy bombardment.

10. If the attack fails it must withdraw, covered by such reserves or other troops as may be available. At this time it will be greatly disorganized and demoralized by defeat and will not be organized to withstand attack.

NOTE: The above gives only general characteristics of the attack. Detailed instructions on the conduct of the attack for small units, together with general rules for combat, are given in Offensive Combat of Small Units, and Infantry Drill Regulations. Instructions on offensive combat contained in those manuals will not be repeated in this book. Troops on the defensive must be kept thoroughly trained in offensive combat not only in order that they may understand how to prepare proper measures to

meet attack, but also in order that they may properly conduct the counter-attack and change from the defensive to the offensive at the proper time.

### *Chapter II.*

#### GENERAL CHARACTERISTICS OF THE DEFENSE.

##### GENERAL MEASURES FOR THE DEFENSE.

11. From a study of the preceding chapter the general measures to be adopted by the defense to meet the attack may be readily understood.

12. When a force is compelled to assume a defensive attitude it selects the ground on which to hold combat, occupies it, and prepares it for defense.

13. The ground selected by the defense on which to hold combat should be favorable for the development and maintenance of a powerful and destructive fire by all arms of the defense. It should furnish protection against hostile fire, especially for the supports and reserves, and for the counter-attacks of the defense. It should contain a series of tactical points along well defined lines, which if held will force the elements of the hostile attack which may succeed in penetrating the position into unfavorable positions for the hostile attack, where they may be held under a destructive fire and captured or destroyed or expelled by counter-attack. It should favor the movement of troops of the defense within the position for supporting or reinforcing elements of the attack and for counter-attack. It should be suitable to the size of the command and should favor the protection of flanks of all elements. This position is the battle ground selected by the defense. Its proper selection and preparation should offset to a great extent the advantages of the offense in selecting the point, direction and time of attack. The practice of holding on to ground which does not give to the defense the advantages of the development and maintenance of its fire power and favor its counter-attack, except as a temporary expedient during combat, is particularly to be condemned. (For further details to be considered in selecting a position see Chapter III, Part I.)

14. The troops of the defense within the position are disposed in depth. This is necessary for their protection against hostile fire, for the protection of the flanks of advance elements, for limiting the progress of hostile elements which may succeed in penetrating the position, and for expelling them by counter-attack. They are formed along a number of lines, firing line, support line, and reserve lines. Each line is prepared for defense. Similar lines are prepared for resistance to the flanks. Tactical units are assigned for the defense of areas of tactical importance along these lines. Local supports and reserves are provided for the support and reinforcement of units holding these areas and

for counter-attack to capture, destroy or expel any hostile element which may succeed in penetrating the area. This insures the close defense of these areas and facilitates control and command. (For details of a position and the occupation of same see Chapter III, Part I.)

15. The defensive position is prepared for defense as soon as the situation permits. This constitutes a part of the military operation. It is an essential part of the defensive combat. This work must conform to the plan of action of the defense. When old positions are occupied they must at once be modified to conform to the plan of action of the new force or the new mission assigned. When new positions are occupied work is at once begun by all arms on the most important parts. This work includes clearing the field of fire, the construction of obstacles to delay the hostile advance and hold it under fire; the construction of fire trenches, emplacements, etc., for protecting the men and increasing and maintaining the fire power of the defense; the construction of observation posts, the construction of shelters, communication trenches, etc. (See Par. III.)

16. Having selected the position the defense at once provides for its security (protection against hostile observation, annoyance and surprise), if it has not already been provided. It is important that information be denied to the enemy as to the location, strength, composition and disposition of troops of the defense. Without this information the hostile attack will be poorly directed and easily defeated. It is important that the defense be protected against surprise. It is the duty of all commanders to see that proper measures are taken to protect their own unit against surprise. If the general measures prescribed by higher commanders do not furnish immediate protection to lower units, lower unit commanders must supplement the measures prescribed by higher authority. (For more detailed instruction concerning security see Chapter IV, Part I.)

17. The defense also perfects its system of information. (See Liaison for All Arms.) It is important that the defense detect promptly the strength, composition, point and direction of the hostile attack. It is important, especially during combat, that a system be perfected for detecting and reporting promptly to the proper arms the exact location and movements of hostile troops, automatic rifles, machine guns, one-pounders, trench mortars, artillery and tanks. These are the targets of all arms. Without this information, the co-operation of combined arms cannot be obtained, and the fire superiority of the defense cannot be developed and maintained. (See Chapter IV, Part I and Part II.)

#### GENERAL FEATURES OF DEFENSIVE ACTION.

18. The defense protects itself against hostile observation, annoyance and surprise by its service of security. It detects

hostile movements, troops and targets by means of its information service.

19. While the hostile attack is developing, the defense attempts to delay the hostile development and inflict losses upon the enemy. In open warfare, or when the hostile lines are distant, an outpost or covering detachment may be assigned this mission. In trench warfare the artillery, machine guns and trench mortars may take part in this work by subjecting located or suspected hostile assembling places, battery emplacements, machine guns, routes of communication, etc., to destructive or neutralizing fire.

20. When the point and direction of the hostile attack has been determined the defense at once takes steps to meet it. The fire mentioned above is continued and the position at the point of attack is reinforced. This reinforcement does not as a rule provide for an increase in the number of men assigned to the firing line. It may not provide for an increase in the number of men holding the position. It may provide for increasing the number of men in local support. It usually provides for increasing the number of men in local (subsector) reserve. It provides for increasing the number of men in division, and general reserves if the threatened attack is large. Against minor attacks and raids this increase is effected without change of position of centers of resistance and subsectors, etc., by calling in supports and reserves of adjacent subsectors and sector reserves. Against large attacks, this reinforcement may be effected by decreasing the front held by various units. The front formerly held by one regiment may be held by two regiments. The front formerly held by one battalion may be held by two. The front formerly held by one company may be held by two. This involves a change in the position and disposition of the troops of the defense. The results accomplished are an increase in local support, local reserves and reserves with which to strike the decisive blow without an increase in the actual number of men holding combat groups. In the preparation of the position for defense one should keep in mind the probability of reinforcing or reducing the strength of the force occupying the position.

21. In order that the hostile attack may be prevented from reaching the first line of the defense, the defense must gain and maintain fire superiority over the hostile attack. Fire superiority is obtained not by the volume of fire, but by a well aimed and well directed fire by all arms, which causes the fire of the attack to become wild and inaccurate. For gaining fire superiority, it is of the greatest importance for the defense to locate and bring to bear the fire of combined arms upon hostile artillery and its observation stations, tanks, trench mortars, machine guns and automatic rifles. These produce the bulk of the fire power of the attack, are mobile, present small targets and are difficult to locate, but when located at close range are easily

put out of action by combined arms. Artillery, one-pounders, trench mortars and machine guns are most effective against these hostile weapons. It is the duty of all commanders from the platoon leaders to the highest to locate and report these hostile weapons to the above arms in order that they may be promptly put out of action. Each platoon should detail a few snipers to locate, report and fire upon these hostile targets during combat.

22. To gain fire superiority:

(a) *During the hostile preparatory bombardment* the defense executes a counter-bombardment with its artillery, trench mortars, one-pounders and machine guns against the hostile artillery, observation stations, trench mortars, machine guns and located or suspected places of assembly of the hostile troops, routes of communication, etc. During this stage, troops of the defense not engaged in the bombardment or moving to points designated for reinforcing the position remain in their shelters with a sentry on duty to give the alarm. Provision must be made for detecting areas subjected to a prolonged gas bombardment and for the relief of troops therein.

(b) *During the advance of the attack* the artillery continues its bombardment. The artillery and machine guns using indirect fire subject the hostile infantry to a destructive barrage. Some pieces using direct or indirect fire should be designated to fire upon hostile artillery which may be closely following the infantry, upon tanks, machine guns, and trench mortars. Trench mortars, machine guns using direct fire, one-pounders and automatic rifles make special targets of hostile machine guns, automatic rifles, one-pounders, trench mortars, tanks, artillery which may be closely following the infantry, and favorable infantry targets (columns, flanks of lines). (See Par. 21, above.) The rifles take the hostile infantry under fire. Snipers locate, report and fire upon the special targets.

(c) *When the hostile attack approaches the assault position in front of the advance line, or when hostile trenches are close, or at night or during fog or smoke and dust of battle*, the artillery continues its bombardment as above. Artillery and machine guns using indirect fire establish a dense barrage close in front of the advance line. Some automatic rifles may be used to cover dead spaces in this barrage (down small ravines). Some pieces continue to look for their special targets. [See (b) above.] Machine guns using direct fire and automatic rifles establish a powerful flanking fire in front of the obstacles protecting the front line. If there be no obstacles, or if the hostile advance has not yet reached the obstacles, then fire is directed upon the advance waves of the hostile attack. At night or in fog or smoke, when the hostile infantry cannot be seen, this flanking fire is established in front of the obstacles, or if there be no obstacles then along the front of adjacent combat groups. This *flanking fire* is the most powerful means of the defense for stopping the

hostile assault. It can always be established in properly prepared positions, no matter how powerful the hostile fire may be. It is by the mutual support of adjacent combat groups with flanking automatic rifle and machine gun fire that the best and surest protection against hostile assault is insured. A single automatic rifle may by flanking fire repulse the most determined assault against an adjacent combat group. Whether it be open warfare or trench warfare platoon commanders must see to it that when the hostile attack approaches the assault position, automatic rifles of their platoons are employed for protecting by flanking fire adjacent combat groups against assault. Special emplacements must be prepared for this purpose which furnish concealment and protection from hostile frontal fire; they are not used until the enemy approaches the assault position. Other machine guns using direct fire, trench mortars, one-pounders and other automatic rifles and snipers continue to fire upon their special targets. Rifles continue to fire upon the hostile infantry, particular attention being paid to the protection of the front of the combat group. Rifle grenades or hand grenades may be used against hostile troops which have taken cover and cannot be reached by direct fire.

(d) *Arresting hostile penetration.* Should the enemy succeed in penetrating the position, the organized areas [combat groups, strong points, centers of resistance and successive lines (see Chapter III)] at once take the hostile elements under fire and check their progress to the rear and flanks and hold them under destructive fire until captured or destroyed or expelled by counter-attack. These areas must present lines of resistance to the flanks similar to the lines to the front. In this fire machine guns stationed to the rear, which at first contributed to the barrage by indirect fire, now change to direct fire and take the hostile lines from the flank. If the penetration is of sufficient size, artillery may assist in this fire. Grenades may be useful against hostile troops which have occupied captured trenches and cannot be reached by direct fire.

(e) *During the assault* adjacent combat groups mutually support each other with flanking automatic rifle and machine gun fire. Before the assault is launched, hostile elements will, as a rule, have worked around to the flanks of combat groups. These hostile flanking elements are subjected to flanking fire from machine guns, automatic rifles and rifles stationed in combat groups in rear. Against assault, obstacles are of the greatest value. Should the assault succeed in breaking through or over these and in reaching the combat group, it is met with the bayonet, the riflemen and grenadiers leaping upon the parapet for this purpose. Automatic riflemen continue to mutually support adjacent combat groups by flanking fire until the last, and do not as a rule take part in repelling the assault against their own combat group. They are already supported by automatic rifles

from combat groups on their flanks and rear, and their frontal fire against assault is of little value.

23. *The counter-assault* is the soul of the defense. It is impossible to retain any defensive system by a merely passive resistance. The attacking force must succeed eventually in driving the defender out of his positions, however well they may be chosen and prepared, unless the latter seizes every opportunity of assuming the offensive. In fact, the character of the defensive, whether passive (merely holding a position) or defense seeking a favorable decision, is indicated directly by the size, strength and composition of the forces held out for counter-attack. On the other hand, in all defensive action the total strength of the forces assigned a purely passive mission (holding combat groups) remains practically constant. In a passive defense, the forces available for counter-attack are made large enough only for expelling hostile troops which may penetrate the position, while in the defense seeking a favorable decision as large a force as possible is held out for counter-attack with which to strike the telling blow and win a decisive victory.

24. A platoon at once expels by counter-attack any hostile troops which may succeed in penetrating the area of its combat group. It at once takes under fire any hostile element which may succeed in penetrating the position outside of the area of its combat group and stands ready to join in or support by fire a counter-attack to capture or expel them. A company, as soon as possible, captures or expels by counter-attack any hostile element which may succeed in penetrating the area of its strong point. (See Chapter III.) It always holds out at least one platoon for this purpose. It at once takes under fire any hostile element which may succeed in penetrating the position outside of the area of its strong point and stands ready to support by fire or join in the counter-attack to expel them. The battalion as soon as possible captures or expels by counter-attack any hostile element which may succeed in penetrating the area of its center of resistance. (See Chapter III.) It *always* holds out *at least one company* for this purpose. It at once takes under fire any hostile element which penetrates the position outside of the area of its center of resistance, and stands ready to support by fire the counter-attack to capture or expel them. The regiment as soon as possible captures or expels any hostile element which may succeed in penetrating its subsector. (See Chapter III.) It *always* holds out *at least one battalion* for this purpose.

25. The above counter-attacks are launched as soon as possible. The success of these counter-attacks depends to a great extent upon the rapidity and precision with which they are made and upon their direction. They should take the hostile attack on the flank if possible. The ground over which these

counter-attacks will probably be made should be carefully studied. In the preparation of the position for defense provision should be made for them. The details of these counter-attacks must, however, be determined by the situations arising during each particular combat, and must not be made according to plans prepared in every detail before the combat.

26. If immediate counter-attack fails to capture or expel the enemy, counter-attack by the sector reserve supported by artillery will be launched as soon as possible.

27. In case the enemy be defeated, he will be in no position to withstand a determined attack. The defense must be prepared at all times to change from the defensive to the offensive and take advantage of the opportunities offered by successful defensive action. The orders to change from the defensive to the offensive come from higher authority (division or higher). The necessity of being prepared to change from the defensive to the offensive, together with the necessity for control during defensive combat, demands that tactical units be not split up, that at all times they be kept well in hand and under the control of their commander, and that for the defensive combat they be dispersed no more than absolutely necessary for their mission and for their own protection against hostile fire.

28. It is a common ruse of the enemy to impersonate our officers and give orders for withdrawing. No troops must withdraw from positions assigned them for defense without a written order which can be identified as coming from a higher commander, or a verbal order given in person by this higher commander. Any person giving an order for withdrawal in any other manner must be promptly arrested and turned over to higher authority. Troops assigned a position for defense must hold on to the last. It is the determined resistance of small units (combat groups, strong points, centers of resistance), that makes successful counter-attack and victory possible.

29. When ordered to withdraw by proper authority, if not already covered by the fire of other elements, assign part of the force the mission of covering the withdrawal of the remainder. This part of the force becomes the rear guard of the remainder and conducts itself accordingly. Two or more step by step withdrawals may be necessary before the rear guard action can be taken up.

### *Chapter III.*

#### A DEFENSIVE POSITION AND DISPOSITION OF TROOPS THEREIN.

30. The preceding chapters have shown the necessity of organizing troops in depth for their protection against hostile bombardment. They have shown the necessity of organizing them in depth in order to reinforce threatened points, in order

to maintain the strength of the advance lines, to support and reinforce them, in order to furnish protection for their flanks, and in order to crush by counter-attack any hostile elements which penetrate the position. They have shown the necessity of preparing for defense a number of lines parallel and perpendicular to the front for the protection of the troops of the defense, and for offering resistance, both to the front and flanks, along a number of successive lines in order to arrest and hold under fire hostile elements which may succeed in penetrating the position. They have shown the necessity of organizing along these lines areas of tactical importance which favor the development of frontal and flank fire for the defense of these lines, and for the mutual support by fire of these areas which, if held, force elements of the attack into unfavorable ground. They have shown the necessity of organizing these areas, large and small, by tactical units, both for purpose of control and for their close defense. These lines and areas and the troops which organize them will be explained below.

31. The *platoon* forms for defensive combat in groups along one or two lines. It may form along one line if both flanks are protected by other elements and the flanks of the groups are covered by fire of other groups in rear. When formed along two lines it can furnish protection to the flanks of its groups in the advance line and offer lines of resistance to the flanks.

32. The *company* forms for defensive combat along two or more lines. It may place two platoons in the firing line and two in support, or three platoons in the firing line and one in support. It is thus able to offer resistance both to the front and flanks. In the initial deployment it must always have available a support for maintaining the strength and positions of platoons holding lines and for counter-attack. The support should be a complete unit, a platoon or platoons. For defense of the front and flank lines, the support may be drawn from platoons which have prepared for defense the second line, or it may be a platoon held out for this purpose.

33. The *battalion* forms for defensive combat along two or more lines. It may place two companies in the front line (each holding two lines) and two in reserve, or three in the front lines and one in reserve. The former facilitates relief of companies in the front line. In this formation it is able to offer resistance to the front and flanks. In the initial deployment it must always have available a reserve for reinforcing companies holding lines and for counter-attack. The battalion reserve should be a complete unit, a company or companies. For defense of the front and flank lines this reserve may be drawn from companies which have prepared for defense the second (battalion reserve) line, or it may be a force held out for this purpose.

34. The *regiment* forms for defensive combat along two or more general lines. It may have two battalions in the

first line and one in reserve. It must always have a reserve available for counter-attack. This reserve organizes the regimental reserve line for defense.

35. To offer successive lines of resistance to the front, and to arrest hostile penetration, each of the above elements prepares for defense the lines along which they are stationed in the initial deployment for combat. Other lines perpendicular and oblique to the front are opened up for communication between the various lines, and selected ones of them are prepared for defense to offer resistance to the flanks. Trenches for fire and communication are constructed along all of these lines. Shelters are constructed at the stations of the troops for the initial deployment.

36. Figure 1 shows the *relative positions* of the various elements of a position. It is only a diagram. The manner in which a position is occupied depends upon:

(a) *The strength and composition of the force occupying the position.* A platoon of 40 men can hold a longer line than one of 25 men. A company composed of platoons of 40 men can hold a larger strong point than one composed of platoons of 25 men. This will present a problem to our commanders when taking over positions held by our Allies. If weak in artillery a preponderance of hostile artillery fire must be expected and disposition for protection made accordingly.

(b) *The nature of the terrain.* In mountainous country, if the front is protected by scarps difficult of access, a battalion may hold several thousand yards. On the contrary, in an important pass or near a road a battalion may hold 800 yards. Similarly in level country, the front of a battalion may be extended if protected by a deep river, lakes or marshes. Opposite bridges or fords the front may be shortened. The terrain also has a great local influence upon the local subdivision of the position into areas and upon the selection of the side for the position. (See Par. 77, Part I.)

(c) *The state of the preparation of the ground for defense.* Larger supports and reserves will be required for a position before it is prepared for defense than after it is properly prepared.

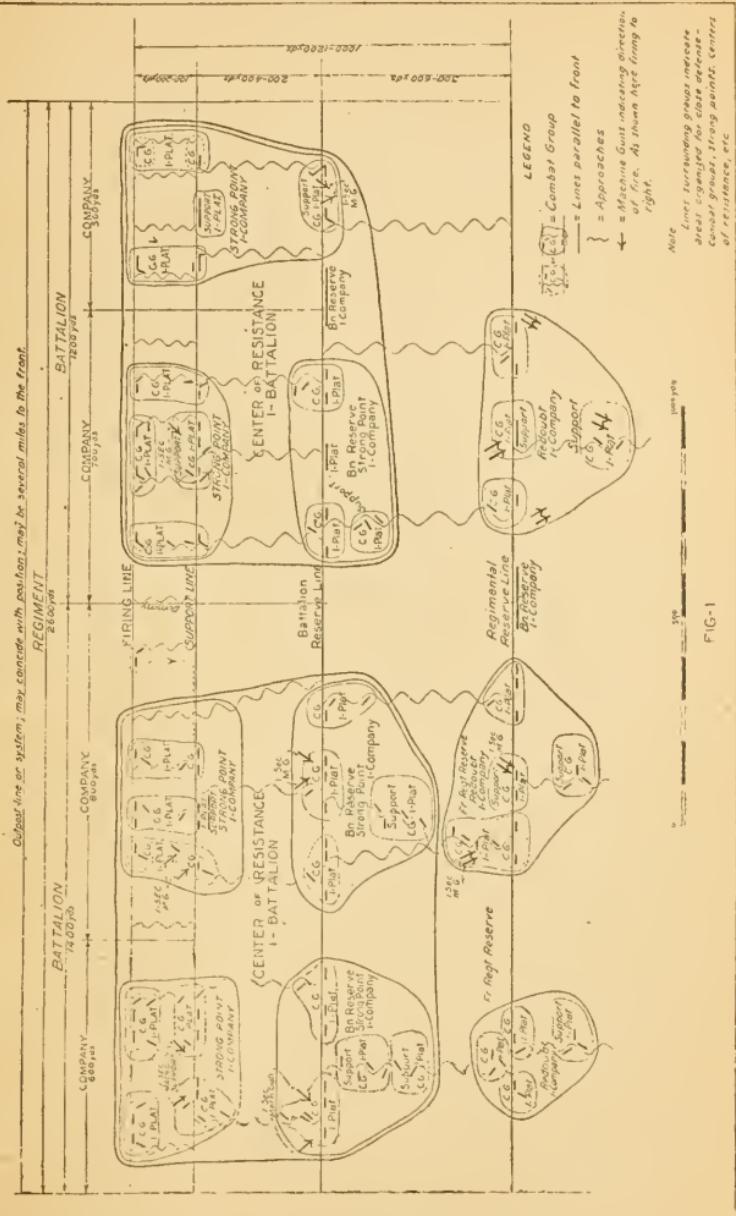
(d) *The protection of the flanks.* If flanks are not protected by strong natural features, supports and reserves must be provided for their protection.

(e) *The tactical situation.* Nearness of the enemy (see Par. 20 above), mission of the command, passive defense or defense seeking a favorable decision (see Par. 23 above).

Figure 1 shows the relative positions and some formations of the units of a regiment holding a subsector. The usual formation for an American division holding a sector is brigades side by side, each with one regiment in line and one in reserve. This provides complete units for brigade and division reserves equipped with trench mortars, machine guns and one-pounders and liaison personnel and equipment, united and trained for

combat, which tactics demand and recent fighting has shown to be necessary. It provides for periods of rest and training as a unit when not holding the line. When four regiments are placed in line side by side no complete unit for reserves is provided.

FIGURE 1.



Where the situation demands that this formation be used, provision must be made for supporting the counter-attack with trench mortars, one-pounders, machine guns, and for liaison personnel and equipment. Some must be held out for this purpose.

37. Lines parallel to the front are called *firing line, support line, battalion reserve line and regimental reserve line*. In rear of each of these lines there may be a cover line. Lines between these are called intermediate lines. Lines perpendicular to the front are called approaches. Lines oblique to the front are called switch lines. The latter are usually formed by a series of sections of lines parallel and perpendicular to the front. In front of or coinciding with these lines is the outpost line or outpost system. (See Security, Chapter IV.) All lines parallel to the front may be called parallels.

38. Trenches along these lines are called firing trench, support trench, reserve trench, cover trench, approach trench, switch trench and intermediate trench.

39. These names are, however, not exact, as we have seen how all may, during a defensive combat, be used as fire trenches, and how all may be used as communication trenches. All should provide easy and rapid communication. All should contain firing emplacements and be organized for defense.

40. The distance between the lines parallel to the front should fulfill the following requirements:

(a) They should be able to cover by fire the flanks of combat groups and strong points holding lines immediately in front of them.

(b) The distance between lines should permit the use of artillery against hostile troops which may have occupied one line without endangering our own troops in another. The safe zone of light artillery is 100 yards. That of heavy artillery is 300 yards.

(c) The distance between lines should be such as to favor rapid and easy counter-attacks against the flanks of hostile elements penetrating the position: 125 yards for a platoon, 250 yards for a company, 500 yards for a battalion. For the same reason the trench containing the force to make the counter-attack must not be too far to the rear. If so it will be caught by the artillery barrage and not be able to make a prompt counter-attack, or if made promptly it will be against the head of the hostile elements and not against the flank. For this purpose the distance of the trench containing the support or reserve with which the counter-attack is made should be equal to about one-fourth to one-half the front held by the unit: 100 to 200 yards for a company, 300 to 500 yards for a battalion, 600 to 1200 yards for a regiment.

(d) The total depth of the position from firing line to regimental reserve line should be about 1000 to 1200 yards.

41. To meet these requirements the distance between the firing line and the support line should be about 100 to 200 yards; be-

between the support line and the battalion reserve line, about 200 to 400 yards; between the battalion reserve line and the regimental reserve line, about 300 to 600 yards; the total depth, about 1000 to 1200 yards. (See Figure 1.)

NOTE.—To fulfill requirement (a) above, sections of approach trenches may be organized, or sections of intermediate trenches may be employed. (See Figure 1.)

42. The distances between the approaches connecting the various lines vary. (See Figure 1.) They should be approximately as follows:

(a) Between firing line and support line, 100 to 150 yards. At least one per platoon.

(b) Between support line and battalion reserve line, 200 to 400 yards. At least two per company.

(c) Between battalion reserve line and regimental reserve line, 400 to 500 yards. At least two per battalion.

Their number and location will also be governed by the necessity of furnishing flank fire for combat groups and flank lines of resistance for strong points and centers of resistance. (See Figure 1.)

43. The strength of a line depends not so much upon the number of men occupying it as upon its proper organization. In Par. 22 (c) it has been explained that the surest and most reliable means of repulsing an assault is obtained by the power of flanking fire of automatic weapons. By selecting positions and constructing emplacements which protect these weapons against the hostile frontal fire, this flanking fire can always be established and maintained night or day, in fog and in smoke or dust of battle, and at a moment's notice. It is quicker and more reliable than the artillery and machine gun barrage. *The defense of a line against assault in both open and trench warfare is based on the flanking fire of the automatic weapons (automatic rifles and machine guns).*

44. The spacing of men at equal intervals throughout the length of the line to be defended does not favor the development of this flanking fire. Even one man per yard equally spaced along such a line would not furnish a strong defense. On the other hand, if the ratio be 10 yards per man, and these men be grouped at proper intervals along the line in such a manner as to favor the development of the flanking fire of the automatic weapons, and riflemen and grenadiers be employed to prevent the flanking fire of the automatic weapons being interfered with, a very strong defense for the line is obtained. (See Figure 1.) In the former case the losses from the hostile artillery bombardment would be ten times as great as in the latter case. As a rule one man per 10 yards of front, with one automatic rifle for every 10 or 15 men organized as indicated above and supported by other arms, is sufficient for the protection of a line against assault. Other troops are provided for supporting and

maintaining the strength of these and for counter-attacks. For the initial deployment in both open and trench warfare it is inadvisable to assign more than one man per 10 yards of front for the defense of a line. Develop to the fullest extent the flanking fire of the automatic weapons of these. Use the remainder for organizing additional lines in rear which protect the flanks of the groups along the lines in front and fire through the intervals, and for supporting and maintaining the strength of groups holding lines and for counter-attack.

45. All lines, whether parallel or perpendicular to the front, along which it is intended to offer resistance should be organized for defense as indicated above. Those perpendicular to the front must include the flanks of strong points and centers of resistance. (See Figure 1.)

46. *The firing line* is the advance line of defense of the position. It contains combat groups stationed at favorable positions along the line for its defense by flanking fire and for the mutual support of adjacent combat groups. It contains light splinter proof shelters for the combat groups. It contains light splinter dugouts. The men could not get out of these in time to man their firing positions to repel an assault. They thus become traps.

47. *The support line* contains the local company supports. It is organized for defense in the same manner as the firing line. Combat groups in this line should protect the flanks of the combat groups along the line in front and fire through the intervals. If the support trench be 100 yards or more in rear of the advance firing line, it should contain deep dugouts for the protection of the men. If it be closer than 100 yards it should contain only light shelters.

48. *The battalion reserve line* contains the battalion reserve. It is organized for defense in the same manner as the the firing line. Combat groups along this line should if practicable be prepared to protect the flanks of combat groups in the line in front and fire through the intervals. Positions along approaches or intermediate lines may be organized for this purpose. If it has no cover line or support line, combat groups may be organized along approach or intermediate lines close in rear to give the organization depth and to protect the flanks of combat groups holding the support line. (See Figure 1.) The reserve line contains deep dugouts.

49. *The regimental reserve line* contains the regimental reserve. It is organized in the same manner as the battalion reserve line and furnishes support by fire to the battalion reserve line in the same manner as the battalion reserve line furnishes support to the support line. It must contain redoubts prepared for all around defense and furnished with two or three days' supplies.

50. *Defensive lines to the flanks* perpendicular and oblique to the front are formed by arranging for the mutual co-operation of combat groups located along the firing line, support line, bat-

talon reserve line, regimental reserve line and intermediate lines, and by such additional combat groups along approaches as may be necessary. Such lines must be organized to protect the flanks of strong points and centers of resistance.

#### DEFENSIVE AREAS.

51. Troops assigned to the defense of sections of lines are so disposed that they can effectively defend the line by flanking fire and at the same time co-operate in the close defense of areas which favor the development of the fire power of the defense. These areas should, when held, force elements of the hostile attack which may succeed in penetrating the position into areas where it cannot properly develop or be properly supported by its own fire power, and where it is held under the destructive fire of the defense, and captured or expelled by counter-attack. These areas are organized by tactical units which provide for their close defense, for supporting or reinforcing groups holding the lines and maintaining their strength, and for capturing or expelling any hostile force which may succeed in penetrating the area. (See Figure 1.)

52. *The Combat Group.* (See "C. G." in Figure 1.) The platoon may be ordered to defend a section of one or more lines parallel to the front and to co-operate in the defense of lines perpendicular or oblique to the front. The platoon organizes one or two combat groups for the defense of the sections of lines and for the support of adjacent combat groups by flanking automatic rifle fire. *The support of adjacent combat groups by flanking automatic rifle fire is the duty of every combat group whether it be mentioned in orders or not.* Where a platoon organizes two combat groups, these groups should not be over 150 yards apart and should be so located that the platoon commander may conduct the fight of both.

3. The combat group always contains automatic rifles, rifles, rifle grenades and hand grenades. It may contain machine guns. A number of emplacements for automatic weapons should be provided along the front trench for firing on favorable targets during the approach of the hostile attack. The automatic weapons must have concealed emplacements for flanking fire which must be protected from hostile frontal fire and observation. These emplacements should not be fired from until the hostile attack approaches the assault position. These flanking emplacements should preferably be located somewhat in rear of the front trench (along approaches or in separate emplacements) in order that their flanking fire may not be interfered with while the remainder of the combat group is repelling an assault. For better protection against one-pounders and trench mortars, these flanking emplacements may be located off the firing lines and approaches. For this purpose this distance should not be less than 20 yards. If so located the emplacements must be perfectly camouflaged. For protection against artillery fire such emplace-

ment would have to be at least 30 yards from approaches and 100 yards from fire trenches.

54. The combat group organizes an area for close defense. This area should be enclosed by obstacles, but these obstacles must be so located or constructed that they do not disclose the location of the combat group. For this purpose low wire entanglements may be employed. Knife rests may be used for blocking trenches. Riflemen and grenadiers conduct the close defense of the combat group. They must not permit the flanking fire of the automatic weapons to be interfered with. Fire trenches for using the rifle are provided for firing both to the front and flanks. Grenades are used against an enemy who has taken cover and cannot be reached by rifle fire.

55. The area organized for close defense by a combat group of twenty men should not as a rule be greater than 50 by 50 yards. The area organized for close defense by a combat group composed of one platoon should not as a rule be greater than 50 by 150 yards. For protection against artillery and trench mortar fire the men must not be concentrated in large groups. They must not be equally distributed in single file throughout the trench. They must be formed in groups of 4 to 8 men, each under a non-commissioned officer, and each under the control of the commander of the group. The group commander must so station himself that he can conduct the fight of the group and at the same time remain in close communication with his higher commander.

56. These combat groups are usually not spaced at equal distances along the line. From Par. 44 it is seen that a combat group of 20 men with two automatic rifles, if properly supported by other arms, may by its flanking fire effectively defend against assault 200 yards of a line. Similarly a platoon of 40 men with 4 automatic rifles may effectively defend against assault 400 yards of line. The position from which the section of line is defended is not necessarily at the middle of the section. There will usually be positions along the section which especially favor the development of fire to the front and flanks. At these positions combat groups are organized. These positions may be entirely to the flanks of the section to be defended. For mutual support and co-operation, however (see Par. 44 above), combat groups should be arranged along well defined lines.

57. Combat groups at once capture or expel by counter-attack any hostile element which penetrates the area of the combat group, and at once takes under fire any hostile element which penetrates the position outside of the area of the combat group and supports by fire or joins in the counter-attack to capture or expel it. The safety of the area held by the combat group must be insured by a detachment, if necessary, when the combat group joins in a counter-attack outside of its area.

58. *Strong Point.* (See Figure 1.) A company may be ordered to defend sections of one or more lines parallel to the front and

sections of adjacent lines perpendicular or oblique to the front, and to insure the close defense of an area of tactical importance located along these lines. For this purpose the company assigns to its platoons the defense of the lines parallel and perpendicular to the front, including those on the front and flanks of the area to be closely defended, and at the same time has a support available to meet various situations. The defensive area thus organized is called a strong point. A company of 250 men may be ordered to hold from 400 to 800 yards of front.

59. A strong point organized by a company for close defense should not be less than 250 by 350 yards, and as a rule should not be greater than 400 yards front by 250 yards depth (if main line of resistance is to flank 250 yards front and 400 yards depth). If less than 250 by 250 yards the troops will be too concentrated for protection against hostile bombardment. If greater than 400 by 250 yards the combat groups cannot be supported promptly, and hostile elements which penetrate the area of the strong point cannot be promptly driven out. If sections of the lines to be held by the company cannot be properly defended by flanking fire from the area included within the strong point, it will usually be better to provide for the defense of those sections by combat groups which withdraw to the strong point when driven from their position, and by machine gun fire within and in rear of the strong point. (See Figure 1.) Strong obstacles should cover such sections. A service of security to detect hostile penetration must be insured. Obstacles should protect the front and flanks of the strong point but must not disclose the location of the strong point.

60. For the defense of the strong point the company is formed for defensive combat as indicated in Par. 32 above. Where the strong point is located along the firing line and the support line the platoons in support are stationed in the support line. Where the strong point is located along the battalion reserve line or regimental reserve line, depth to the strong point is secured by organizing combat groups along approaches or intermediate trenches in rear, and by placing platoons in support in the approaches or intermediate trenches in such a manner that they will be most conveniently located for supporting and reinforcing elements holding the lines and for counter-attack.

61. The company at once captures or expels by counter-attack any hostile element which penetrates the area of the strong point, and at once takes under fire any hostile element which penetrates the position outside of the strong point and supports by fire or joins in the counter-attack to capture or expel the hostile element. If the company joins in the counter-attack outside of its strong point it must, where necessary, insure the safety of the strong point by a proper detachment. The platoons employed by the company for its counter-attack may be those assigned to the defense of the second line, or a platoon may be held out for that purpose.

62. The company commander must remain in close communication with his platoon commanders at all times, and must conduct the combat of his company. His command post will be located with this object in view. It will usually be located in the support trench, or, for the defense of strong points along the battalion reserve or the regimental reserve trenches, along an approach trench or intermediate trench 100 to 200 yards in rear of the firing line.

63. Strong points support by flanking fire adjacent strong points. Those located along the battalion reserve and the regimental reserve lines protect the flanks of strong points in front. Temporary combat groups may be organized along approaches or intermediate lines for that purpose.

64. *Center of Resistance.* (See Figure 1.) A battalion may be ordered to defend sections of the firing line, support line and reserve line and adjacent lines perpendicular or oblique to the front, and to insure the close defense of area of tactical importance along those lines. For this purpose the battalion assigns to its companies the defense of sections of the lines and the close defense of areas of tactical importance in such manner as to insure the defense of the lines and the area to be closely defended, and at the same time have a reserve available to meet various situations. The defensive area thus organized is called a center of resistance.

65. A battalion of 1000 men may be ordered to hold from 800 to 1600 yards of front. The center of resistance organized for close defense by the battalion should not be less than 500 by 500 yards, and as a rule should not be greater than 1000 yards front by 600 yards depth. If less than 500 by 500 yards the troops will be too concentrated for protection against artillery fire. If greater than 1000 yards front by 600 yards depth it will be difficult to reinforce the strong points in time and to capture or destroy hostile elements which penetrate the area. The distance between strong points holding the front of the center of resistance should not be greater than 400 yards. The distance between centers of resistance should not be greater than 800 yards. (For protection of intervals see Par. 59 above.) Obstacles should protect the front and flanks of centers of resistance but should not disclose their location. For the defense of the center of resistance the battalion is formed as indicated in Par. 33 above.

66. The battalion at once expels by counter-attack any hostile element which penetrates the area of the center of resistance not expelled by strong points, and takes under fire any hostile elements which penetrate the position outside the center of resistance, and supports by fire or joins in the counter-attack to capture or expel them. If it joins in the counter-attack outside its center of resistance it must insure the safety of the center of resistance by proper detachments. For the defense of front and flanks of the center of resistance, the companies

assigned to the defense of the battalion reserve line may be employed for reinforcing strong points and for counter-attack; or a company may be held out for that purpose.

67. The battalion commander must so station himself that he can remain in close communication with his company commanders and conduct the fight. His command post should as a rule be located along the battalion reserve line.

68. *Subsector.* A regiment may be ordered to hold from 1600 to 3000 yards of front. For this purpose it divides the front of the position (firing line to battalion reserve line inclusive) into two sections, and assigns a battalion to the defense of each of the sections (see centers of resistance above), and places the third battalion in the regimental reserve line as a reserve. The section thus held by a regiment is called a subsector.

**NOTE:** Where the division places four regiments side by side, each regiment with a battalion in the front line, a battalion in support, and a battalion in reserve or at rest, the front held by the regiment becomes that of a single battalion. (See Par. 65 above.) In this case the regimental reserve line should be garrisoned by the support battalion.

69. The third battalion organizes the regimental reserve line for defense. (See Par. 49.) The regimental reserve line arrests any hostile element which penetrates the position. It should be continuous. The battalion garrisoning it at once captures or expels by counter-attack any hostile element which penetrates the subsector and which is not eliminated by battalions holding centers of resistance. It should be used sparingly for reinforcing centers of resistance, and should rather rely on counter-attack to re-establish sections of centers of resistance which may be captured.

70. *Machine Guns.* The employment of machine guns is explained in the supplement to Machine Gun Drill Regulations, Tactical Use of Machine Guns (A. E. F., July, 1918). (See Pars. 37-50 of those instructions.)

71. Figure 1 indicates a possible disposition of machine guns within a subsector. It is assumed for purposes of illustration in the figure that one machine gun company of the brigade battalion has been attached to the regiment. Other machine guns under control of brigade machine gun battalions may be deployed in rear of the position for establishing a barrage by indirect fire in front of the position and for support of counter-attacks.

72. In the diagram one company is deployed (by section) along the support and the battalion reserve line for establishing a powerful flanking and oblique fire in front of strong points. The obstacles covering these lines should be so located that they can be swept by this fire. In case the enemy penetrates the position these may be employed for establishing a powerful flanking fire in front of their respective lines and for supporting counter-attacks.

73. The other company is deployed near the regimental reserve line. These guns may be employed for the machine gun barrage in front of the advance line, for supporting by indirect fire sections of the front line, and for protecting intervals between the flanks of strong points and centers of resistance. (See Pars. 59 and 65 above.) The obstacles protecting flanks of strong points and centers of resistance should be so located that they may be swept by this fire. If the enemy penetrates the position these guns may employ direct fire to check his advance, to cover the front of the regimental reserve line with a powerful flanking fire and to support counter-attacks.

74. *Trench mortars and one-pounders.* For the part played by these weapons in the defense see Par. 22 above. The proper use of these weapons plays a very important part in gaining the fire superiority by their destruction of hostile machine guns, trench mortars, one-pounders, automatic rifles, tanks, and artillery which may be closely following the infantry. Trench mortars also play an important part in supplementing the artillery and machine gun barrage, and supporting strong points which may be threatened by assault, by establishing a barrage in front of same.

75. Various emplacements should be so arranged as to take advantage of the mobility of these weapons. They are usually located near or in advance of the support line. The system for pointing out targets to these weapons must be perfected to the highest degree. In the counter-attack special attention should be paid to locating and destroying hostile machine guns which may have been advanced to take the counter-attack of the defense on the flank.

76. *Artillery.* The part played by the artillery in the defense is explained in Par. 22 above. Communication between the infantry and the artillery must be perfected to the highest degree in order to obtain perfect co-operation between the artillery and the infantry. (See *Liaison for All Arms.*)

77. *A Position.* The whole of the organization along a front occupied by the troops of the defense as described above constitutes a defensive position. On a defensive front a second position 6 to 8 kilometers in rear of the first is selected and prepared for defense. This distance is necessary in order that the second position cannot be subjected to the preparatory artillery fire at the same time as the first. Similarly a third position, 6 to 8 kilometers in rear of the second, may be selected and prepared for defense.

78. *Switch positions* may connect the above positions, which serve to present an unbroken front in case a section of the front position be captured. They serve also for bases of departure for large counter-attacks.

79. *Intermediate positions* may be constructed between the successive positions, which serve to protect the artillery supporting the position and insure its continuity of fire in case the

position in front be penetrated. They serve also as a base of departure for counter-attacks. They may also be used as a new first line position.

80. *Sectors.* A defensive front is divided into *sectors* in such a manner that their defense will be united and certain. A sector generally takes in at least two positions. A sector is usually defended by a division. It may be defended by a brigade or army corps.

NOTE: The various positions mentioned above are organized to conform to their mission.

For example: The second position is intended for a main line of resistance; it should be organized similar to the first main line of resistance which has been explained in detail in these instructions. Switch positions have a similar mission; they may also serve as a base for counter-attacks. Intermediate positions may be used to protect artillery only, or as bases of departure for counter-attacks, and sometimes as a new main line of resistance. The mission of an outpost is to maintain contact with the enemy, keep him under observation, cover the main position, and delay a hostile attack in force. In case of a hostile attack in force, it may be the mission of the outpost to delay the hostile advance, and not to attempt to hold its position. For this purpose, a number of successive positions favoring step by step withdrawal may be prepared for defense. These positions should be so located that they can cover by fire the withdrawal of troops from the next position in front. In this action the reserve, instead of being located close to troops in the front lines as is required for counter-attack in holding a position, may be located in the next withdrawal position in rear.

In preparing for defense positions in rear of the first main line position, the parallels and approach trenches, which are subject to deterioration under bad weather and which could be rapidly constructed when needed, may be excavated to a depth of 1 to 1½ feet only. Heavy maintenance will thus be avoided.

81. *Selecting a Position.* In selecting a position due consideration must be given to the fact that a position consists not of one line but of several lines, and that counter-attacks, the soul of the defense, should be protected from hostile observation and fire. The location of the *front line* of the position will depend upon:

(a) The tactical situation. During or immediately after an engagement one may be forced to hold on to captured ground in contact with the enemy. If it is not intended to resume the offensive, and this ground does not favor defensive combat, a suitable position should be at once selected in rear and occupied and organized, and contact maintained with the enemy by outposts. Useless losses will thereby be avoided. If the enemy desires, let him occupy the unfavorable ground and suffer the losses. (See Combat Instructions, June 29, 1918.)

(b) Flanking fire for the protection of the front line against assault.

(c) Fire on the foreground to the effective range of artillery and infantry.

(d) Requirement (c) above demands good observation. At the same time observation should be denied the enemy especially for the protection of the supports and reserves and for the counter-attack.

(e) Artillery support close in front of the advance trench.

82. A study of the advantages and disadvantages of the various sites shown in Figure 2 will assist one in selecting a good position to meet special situations.

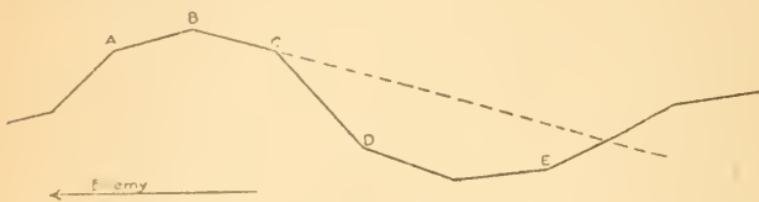


FIGURE 2

(a) At A there is a good field of fire and distant observation, but artillery support is very difficult on the slopes in front of A. For however slight the slopes in front of A may be, field artillery can effectively reach them close in front of the advance line only by batteries placed in flanking positions (if it be possible to find favorable positions for proper development of fire). Moreover, hostile artillery readily sees trench A. The enemy can effectively support his infantry.

(b) At B there is distant observation, but the field of fire B—A is usually short. All terrain in rear of B is concealed from hostile observation. Artillery support on terrain B—A is very difficult as this terrain is seen only from B.

(c) At C (reverse slope) distant observation of the enemy is entirely lost. The field of fire C—B is short, but there are no difficulties of close artillery support. The enemy has distant observation on B, but beginning at C the terrain has a large dead angle from enemy's observation. Hostile artillery will have difficulty in firing on slope C—D.

(d) At D there is the benefit of good support by artillery, and on the other hand, hostile artillery support will be difficult. All ground in rear of D is subjected to hostile observation and fire.

(e) At E there is a large field of fire, the enemy's ground is well observed, artillery support is good, but the enemy has the same advantage. The ground from E to the next crest in rear is subjected to hostile observation and fire.

From the above it is seen that the position at C presents important advantages for employing the means of defense in holding the position. The lack of observation of the hostile position decreases the possibility of action against the enemy at

all times, and especially in case of offensive operations. One should, therefore, seek to obtain the advantages derived from having observation without losing the advantages of reverse slope positions. To retain observation, the position in front of the crest is selected and attempt is made to lessen the inconveniences of this position, which consist principally in difficulty of artillery support, by organizing a dense flanking fire (infantry and artillery).

83. The general alignment of the trench will be governed by the above requirements. For the development of flanking fire small bends and curves in the general alignment are advantageous, but the general alignment of the line should be straight and prominent salients avoided.

84. *Villages and woods* are organized according to the general principles given above, and by using to the greatest advantage their peculiar properties mentioned below.

85. *Defense of villages.* Villages furnish good concealment against terrestrial and aerial observation. It is easy to construct concealed works within them. The advance is confined to channels which may be covered by flanking fire. The cellars, if reinforced, furnish good protection against bombardment. Taking advantage of the above, strong points may be constructed within the village. A few men may be assigned to this mission and the remainder held out for counter-attack within, but more often without the village. The danger of being surrounded is guarded against by powerful flanking fire, and by strong points echeloned in depth with the intervals swept by fire, and by counter-attack.

86. *Defense of woods.* Woods furnish cover against hostile observation and constitute an obstacle to the hostile advance. A prolonged bombardment may cause them to lose these properties to a greater or lesser extent. They are at first organized as though the cover and obstacles they furnish were indestructible. Combat groups are organized for flanking their edges, blocking the roads leading in and halting the enemy within the woods (combat groups within the woods). Arrangements are made for counter-attack. Obstacles are constructed along the edges of the woods; other lines in zigzag in the interior, so as to be flanked by fire; bands connect the various lines so as to partition the woods. Improve the system of communication. Do not clear the woods as it indicates the parts organized. For the same reason clear the underbrush with prudence.

87. As the cover becomes destroyed by hostile bombardment, make the organization continuous in the same manner as for open ground.

#### Chapter IV.

##### SERVICE OF SECURITY AND INFORMATION.

88. The *service of security* embraces all those measures which are taken to protect the command from hostile observa-

tion, annoyance and surprise. The *service of information* embraces those measures taken to obtain information of the enemy. At the front these two services work in conjunction with each other. The principles of these two services are explained in the Field Service Regulations. Details of the organization are explained in Intelligence Regulations, Instructions for Regimental Intelligence Service, Liaison for All Arms, Patrolling Observation and Sniping, and Defensive Measures Against Gas Attacks. These should be carefully studied.

89. Upon the Services of Security and Information depends to a great extent the success of defensive action. If the enemy can be prevented from obtaining accurate information as to the location, strength, composition and disposition of the elements of the defense, his attack, if made at all, will be poorly planned and ill-directed, and should be easily defeated by a well organized defense. If the enemy be not prevented from annoying the troops of the defense, he will be continually inflicting losses upon them, and preventing them from obtaining rest. If the defense does not continually take proper measures to protect itself against surprise, it may be caught unprepared and captured before it can take up proper formation to meet the attack. Of special importance is the protection of front and flanks (especially valleys or ravines on the flanks) at night and during fog and smoke or dust of battle. If sufficient information on the enemy be not obtained and be not promptly transmitted to the proper place, the strength, composition, point and direction of the hostile attack cannot be determined in time for the defense to take proper steps to meet it (see Par. 20, above), nor can the proper co-operation of the combined arms be obtained for combatting special hostile targets in the fight for fire superiority, for establishing the barrage and flanking fire for protection against assault and for capturing or expelling the counter-attack. In a defensive combat no one platoon and no one company should have to fight alone and unsupported. This will not happen if the co-operation of combined arms is secured.

90. Special provisions made for the two above services by the defensive are as follows:

- (a) Outpost or covering detachments;
- (b) Patrols;
- (c) Observers and sentinels;
- (d) Aerial observers;
- (e) Snipers;
- (f) Harassing fire;
- (g) Means for giving alarm (against hostile troops and against gas);
- (h) Means for transmitting information.

91. In open warfare and in trench warfare, when the two lines are at a distance, an outpost or regular covering detachment may be required. In the present war outposts will be

more often needed when the end of an engagement leaves our troops in a disadvantageous position for fighting a defensive combat. If the position held does not favor defensive combat, a favorable position should be selected to the rear and prepared for defense. The ground in front should be lightly held by an outpost, to keep the enemy under observation. (See F. S. R. and Combat Instructions, dated June 29, 1918.) Such an arrangement is desirable in that it gives the main body time to prepare for defensive combat and protects it from annoyance by the enemy. On the field of battle tactical considerations must govern.

92. The details of the conduct of patrols, observers, sentinels, snipers, harassing fire, means of giving alarm, and means for transmitting information are given in Part II, Infantry in the Trenches, of these instructions, and in F. S. R., Intelligence Regulations, Regimental Intelligence Service, Liaison for All Arms, Patrolling Observation and Sniping, and Defensive Measures Against Gas Attacks.

## Part II.

### INFANTRY IN THE TRENCHES.

1. Infantry in the trenches very often undergoes what is known as a period of stabilization. This situation sometimes lasts for several months.

During shorter critical periods it is in its trenches *under attack or going out to attack*.

Instruction for duty in trenches and under attack is given below.

#### *Chapter I.*

##### INFANTRY DURING THE PERIOD OF STABILIZATION.

2. *Plan of defense.* During a period of stabilization the commander of troops must consider beforehand the different missions he may eventually have to execute, collect information, reconnoiter the terrain or have it reconnoitered. In this way he will be prepared to take his troops into action.

These instructions show briefly the duties of the officers of a company intrusted with the defense of a certain sector, or a *strong point*.

3. Each officer commanding a unit, large or small, must establish a plan of defense, aimed at overcoming superior forces to which he may be opposed.

This plan must be made known to all subordinates connected with its execution. It is based on knowledge of the terrain and of the enemy, and must take into consideration the following:

Determination of the probable points that may be attacked.

Selection of the main points of resistance and the strength required to occupy them.

Preparation of counter-attacks.

Provisions for communication, supplies, disposition of casualties, liaison, and ground observation.

This plan is drawn up in conformity with the plan of the next higher commander.

4. *Defense of a position* involves the following principles:

(a) Disposition in depth is the fundamental principle of every defensive plan. It enables the enemy to be stopped at successive points selected in advance, where resistance has been prepared.

(b) Each combat group, each point of resistance (barrières, crossways prepared for defense, etc.), must have a leader responsible for its defense and maintenance.

(c) *Troops intrusted with the defense of an area of ground must under no circumstances abandon it.*

It is important to leave no doubt about this matter in the minds of the troops. The existence of stronger lines of defense to the rear, the division of the company into guard and support fractions, *never* implies that advance elements can take the initiative in falling back on the support trench even though they consider their positions to be untenable.

All resistance must be made *on the spot, in the position that is occupied*, and such resistance must cease only when the troops are disabled or when they receive from the superior commander specific and authentic orders (preferably written) to occupy another post.

All such orders received verbally from an uncertain source are not to be considered. Orders to fall back are especially suspicious when passed along the line of skirmishers.

The action to be taken in the case of attack is explained to the smaller detachments, and the orders on this subject must always be very clear.

Those stationed in observation posts are the only ones whose orders provide for automatically falling back on the main position under certain circumstances, which are very carefully specified for each particular case.

(d) All lost ground within the area assigned for close defense is recovered by counter-attacks launched immediately and with troops especially reserved for this purpose.

In a strong point (company) one or several support platoons may be assigned missions of counter-attacking. These conditions are carefully set forth in the plan of defense of the strong point.

The plan of defense for the battalion considers the possible points at which the enemy may penetrate and provides for each a suitable counter-attack. Each company or platoon receives a copy of that part of the plan relating to its task. The details of the execution of the counter-attacks will depend upon the situation arising during combat.

The mechanism of counter-attacks is explained below (Chapter II).

5. *Reconnaissance of a company sector.* When a company is to go into the trenches at night, reconnaissance of the sector must be made during the preceding daylight hours by the captain and the leader of each platoon. An officer or a sergeant is sufficient to conduct the company at night to the entrance of the communication trenches.

The above reconnoitering party also includes the company liaison group. This group remains in the trenches to study completely the plans of defense and the ground.

Companies being relieved will furnish the following guides for incoming companies: one for each platoon, one for the rolling kitchen, and one for company headquarters. Battalion

headquarters also furnishes a guide for the incoming battalion headquarters. These guides meet the incoming organizations at designated entrances to communication trenches at the time ordered and conduct them to their places.

6. *Plan of defense of the company sector.* The four platoon leaders assemble at the command post of the captain, study the plan of defense of the company sector and receive the explanations of the captain commanding the outgoing company. The captain assigns his four platoons to the different combat groups of the sector. Each platoon leader then goes with his liaison agent and his guide to the post of the leader of the platoon that is to be relieved.

The relieving captain is in no way required to base his arrangements and orders exactly on those of his predecessor. However, to facilitate the relief during the night, always a delicate operation, it is preferable that the relief be made by platoon or by groups, and to delay until daylight the changes which the captain desires to make in the interior distribution of his strong point.

7. *Plan of defense and orders for each platoon.* Each platoon leader examines rapidly the parts of trenches and the shelters his platoon will occupy, as well as his own command post. He sends back his liaison agent to the captain and his guide to meet the company, after having shown to the guide the assignment of the half platoons. The guide returns through the communication trench (with a written authorization if passage in one direction only is allowed), noting en route all necessary guide marks, placards, etc.

The platoon leader obtains from the outgoing platoon leader an extract of the plan of defense for the combat groups, and with him makes a detailed examination of the ground. This extract of the plan of defense comprises:

(a) For a platoon on guard (Figure 3) or in the first line: *the precise role of each combat group or islet of resistance whose defense is intrusted to the platoon* (for example, to sweep a part of the ground in front, or to flank one of the neighboring elements, etc.).

(b) For the support platoons: *the combat positions in case of alarm, the support to be given, or counter-attack to be launched, in the cases considered in the plan of defense of the company sector.*

8. *Example.* Figure 3 gives an example of a simple disposition.

A quarter of the strength is on the line, the remainder divided between the cover trench or sections of approach trenches and the support trench. The platoon at the center and the support platoon alternate in occupying a redan and two small flanking works. Each of the two other platoons guards one of the trenches of the first line, assigning such duty by roster to its half platoons.

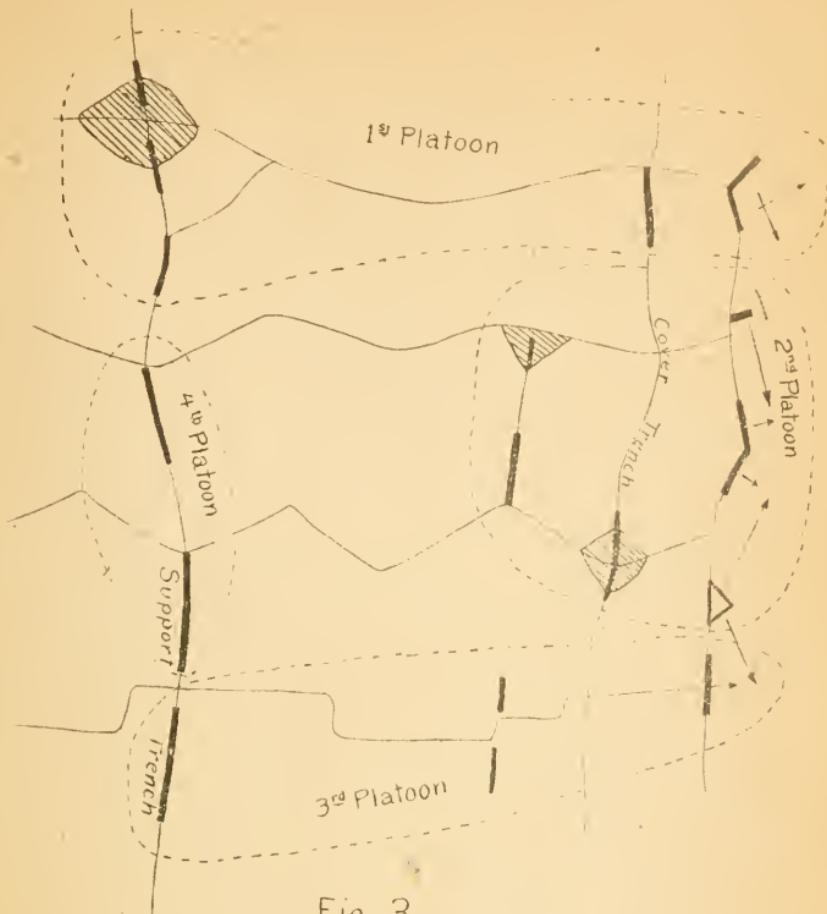


Fig. 3

9. *General remarks.* The task given to a platoon occupying part of a line in the trenches or in the fight, is always very simple. The difficulty is to communicate this task to all concerned with such precision and clearness that under no circumstances will anyone fail to execute his part, even under the stress of conditions that could not have been foreseen.

*To do exactly what has been ordered, to carry out to the letter what has been found necessary, is, in the defense as well as in all other operations of the platoon, the whole secret of success.*

## NOTES FOR THE PLATOON LEADER.

10. When the platoon leader has thoroughly grasped the particular part his platoon is to play in the whole defense scheme,

he can then easily solve all tactical measures and details. This must be his constant consideration during his tour in the trenches.

He receives from his predecessor all information given below which is suitable for every leader of a combat group.

(a) *Extract from the plan of defense.* The part to be played by the platoon combat groups in the situation at hand; detailed sketch of the dispositions; role of neighboring platoons; liaison with them and with the captain.

(b) *Defense.* Number of combat groups formed from the platoon. For each of them: location and tasks of the automatic weapons; location and assignment of riflemen, hand bombers and rifle-grenadiers, their field of fire and duties. The platoon leader obtains this information from the *duplicate of the orders for each combat group*, which is discussed later.

Location of neighboring trench mortars and their field of fire.

Barrage formed in front of the platoon by machine guns placed outside of the strong point (company sector), and signals for beginning and stopping this barrage.

Location, strength and capacity of dugouts; defensive measures against gas; nearest aid-station.

Accessory defenses and hidden passages through the barbed wire.

Information concerning the enemy; sketch of the hostile trench; record of observations; reference points.

Exposed points; projectiles fired by the enemy; hostile mining works; unexploded shells.

(c) *Observation.* Lookout posts with special orders pertaining thereto; listening posts; patrols in front of the accessory defenses and their rounds.

(d) *Material.* Recesses for cartridges, grenades and rockets, condition of the grenades and rockets; shields, periscopes, trench tools, demolition tools, different material of permanent installation; defense equipment against gas, nearest water supply.

(e) *Works.* Under construction or ordered; repairs to communication trenches.

(f) *Location of latrines, cess pits; sanitary condition of the trenches.*

11. *Distribution of the platoon between the fire and support trenches.* As the occupation of a strong point by the same company lasts several days, it is necessary to define clearly to each party (and in each party to each man) the periods of rest and the periods of duty, rather than to keep all men in a situation which is neither rest nor fighting. The principle is to place in the fire trench and in the lookout posts only the men strictly necessary for its security, for harassing purposes and for work (strength being between one-third and one-sixth of

the company). Other men are in the cover trench or support trench, resting or occupied in other work.

According to circumstances, the captain designates two guard platoons and two support platoons, or he may place three platoons disposed in depth, in the front and cover trenches, while the fourth is placed in the support trench. (See Figure 3.) The platoon or half platoon leader then assigns duties within each combat group.

The only absolute rule is that *every combat group must have at all times a responsible non-commissioned officer present*, and the strictest discipline must be required of those who are on duty in the fighting posts. They must be relieved as often as necessary, in order that their watchfulness may not be diminished. Men who are due to be relieved should not be continued on extremely exacting duty.

For the same reason, the captain details an *officer on watch* (platoon leader) whose duty it is to observe the entire surroundings of the strong point and especially towards the front.

12. *Orders for a combat group.* Each combat group, even if it consists only of a few men in the charge of a corporal, must have its written orders. This is the only means of avoiding the inevitable misinterpretation and omissions which characterize the transmission of verbal orders. These written orders are usually too long, are confused and the essential points are often omitted or not brought out. It is well to have them conform to a standard model. The following system may be used:

On the front of the card:

*Orders for Combat Group No. —*

*Commander* (in pencil).

*Provisional commander* (in pencil).

*Strength.*

Next furnish three copies of a sketch of the terrain and name these copies:

- I. Limits of the group and day positions.
- II. Night positions.
- III. Combat posts.

Upon these sketches will be shown the weapons (with their sector of fire) and the men, indicated by means of the conventional signs.

A closing paragraph:

*Conduct in case of an attack* will generally contain only one indication—to resist on the spot; the duty of each individual being clearly indicated in sketch III, if it has been well made. If necessary, there should be added the firing direction for the automatic weapons when a barrage is signalled, the signal being specified (in pencil).

For example, upon sketch I would be shown: 1 trench observer or lookout, 1 other lookout at the door of the rest

shelter, 1 automatic rifleman on duty beside the automatic rifle, and 1 corporal of the guard. Upon sketch II the trench lookout and the automatic rifleman will be doubled and an advanced post will be occupied by 1 corporal and 4 men. Upon sketch III every private and non-commissioned officer of the detail will be assigned his place of duty.

The front of the card will contain only the preceding details with the greatest number of sketches and the minimum number of words.

On the reverse side of the card, or another sheet of paper, will be entered, under the title "Miscellaneous Intelligence," all other details which it is deemed useful to transmit in writing.

It is easy to work out a model of an order drawn up in the same manner, with very clear sketches, for platoons and half platoons assigned to a counter-attack.

#### 13. How to make use of written orders.

Orders for combat groups (and for machine gun emplacements) must be in writing so as to be sure that there will be a record kept, a memorandum always up to date for reference, which can be passed to succeeding groups and will serve for the information of superior officers regarding the orders in force. *Orders, however, must be memorized.* A group leader must be so familiar with his duties that it will not be necessary for him to refer to written orders. Written orders must not be supplemented by verbal modifications, except to meet emergencies during combat; any such changes must be made in writing as soon as the situation permits.

14. *Choice and duty of the observers.* Any man in a company can perform the duty of sentinel at a bombproof shelter, but not everyone can be an observer.

Some are naturally more qualified for observers than others; ability is developed by exercise. *The training of good observers is a matter of the greatest importance.*

They must not only be able to see without being seen, but they must have tenacity and patience to observe.

Trench warfare permits the training of enthusiastic observers. The responsibility for this training rests on company officers

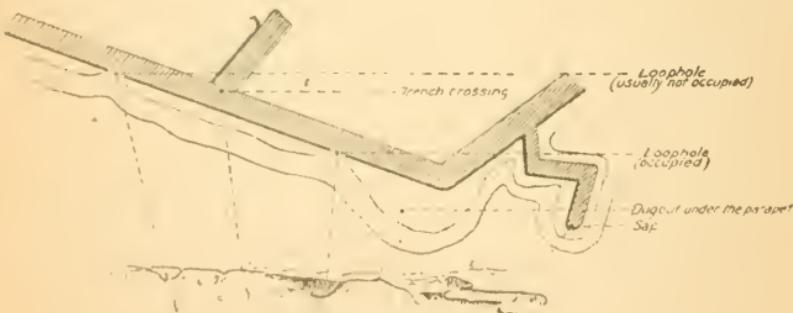


Figure 4.

under whose daily control the observers serve.

The intelligence officer and his assistants question them frequently.

It is well to have them make notes of their observations. Each platoon should have at its disposal at least 6 observers of excellent sight who are good shots. They alternate on duty in order to insure continuity of observation and are excused from certain other duties. They watch over a clearly defined portion of the enemy's position. The view is usually oblique to the posts they occupy, and sectors should slightly overlap each other (Figure 6). If possible they are furnished with a pano-

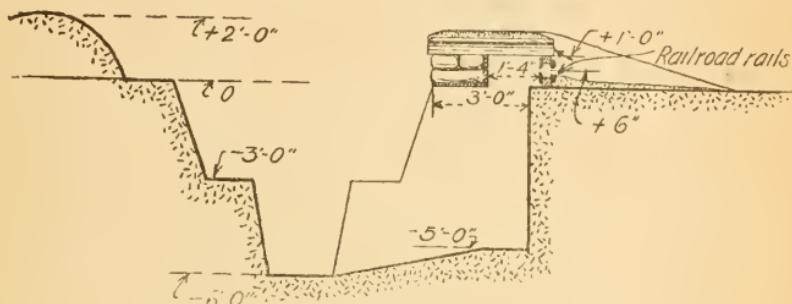


Figure 5.

ramic sketch (Figure 4). The sentinels observe either from an armored shelter, from lookout posts (Figure 5), through an oblique loophole in the parapet (Figure 7) or by means of a periscope. At night they observe above the parapet (Figure 8).

The least change in the enemy lines (obstacles, ground dug up), or any other indication of preparations for an attack should be reported to the watch officer.

Observers watch particularly the points to which their attention has been drawn by preceding observers and upon which they may hope to fire with success. They try to observe without being observed, through a narrow and well hidden loophole.

Patient, attentive observation always gives valuable information about the enemy's customs (time for reliefs, supplies, etc.).

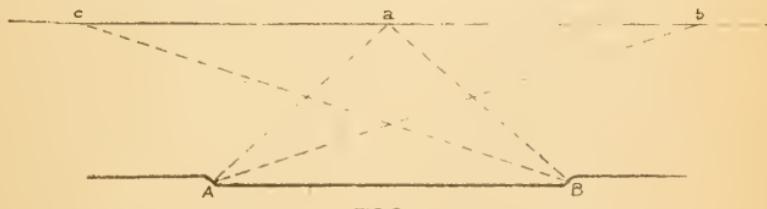


FIG.6

(a-b) Part of hostile trench watched by Lookout A

(a-c) Part of hostile trench watched by Lookout B

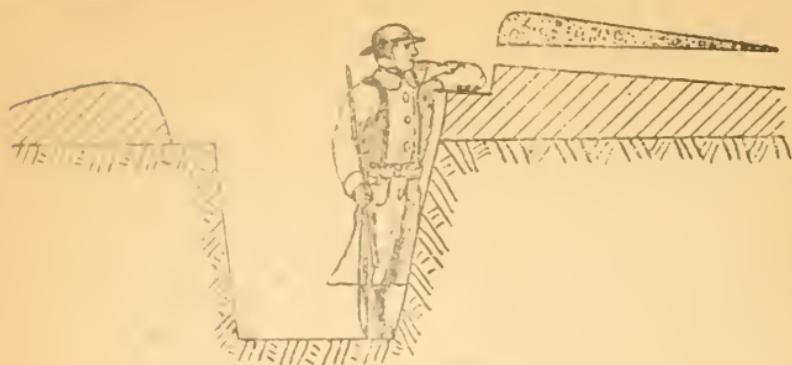


Fig. 7



Fig. 8

Dust blown up by a shot, or smoke from a cigarette may reveal a loophole habitually occupied. In such a case the point should be observed with field glasses, and a rifle on an improvised stand or an automatic rifle trained upon it. Earth thrown up indicates that a fatigue party is constructing a dugout. A small earth heap and smoke reveal the location of a dugout. Study of the battle map and of aerial photographs may show the location of crossroads and the most important communication trenches, upon which it is always advisable to fire with trench mortars at hours when they are supposed to be occupied.

When the enemy is shelling our lines, the inquisitive ones will look through the loopholes to see the effect produced. This is the moment to catch them. All means should be used to attract their attention, such as shouting, dummies, simulated fire, placards, etc.

Every effort should be made to locate machine guns, trench mortars, observation posts, etc., and to interpret the presence of the smallest object or any unusual sign appearing on the enemy's side. This information is indispensable in case we attack, and also to insure the *daily wearing down of the enemy*.

The observers may combine their special work with that assigned to ordinary lookouts, giving the alarm by the means at hand in case of surprise attack or an attack preceded by a bombardment; giving the gas alarm; noting the enemy's projectiles, which fall upon a given point; observing and repeating the prearranged signals.

15. *Advanced posts.* These are used to observe accessory defenses when they are very wide, or to flank the front of the trenches. (See Figure 9.)

In case of alarm the communication trench which connects these posts with the fire trench must be instantly blocked or barricaded by the sentinel who falls back after having given the alarm. Besides, it must be swept by fire from a loophole especially established for this purpose.

The careless use of advanced posts must be avoided. They are easy marks for hostile raids and they may interfere with flank protection of the main trench. They should be employed only when their purpose can not be served by some part of the trench, or when they can be connected by a lookout trench. Moreover, it is strictly forbidden to have them occupied at night by only two men. The minimum garrison is 4 privates and 1 non-commissioned officer.

When they are opposite hostile advanced posts, they may be fitted with three platforms for grenadiers (Figure 10).

16. *Lookouts in second and third lines.* Lookouts are posted near the command post in the second and third lines for observing the whole terrain and repeating signals and rockets from the first line.

17. *Patrols.* Observation is increased during the night by patrols, whose mission and strength depend upon the proximity of the enemy. They are armed with shot guns, pistols and offensive grenades.

They are detailed by the captain or the battalion commander. Their strength should be sufficient to bring back any wounded or prisoners and, if necessary, to establish connecting files back to their starting point.

They always have a definite mission; to reconnoiter such a point, to prepare an ambush at such a place, to remain listening for a fixed time, etc. The success of a patrol depends on the

choice of its leader; in him lies its will and audacity; the members of the patrol are his security and escort. It is the leader who must go and see.

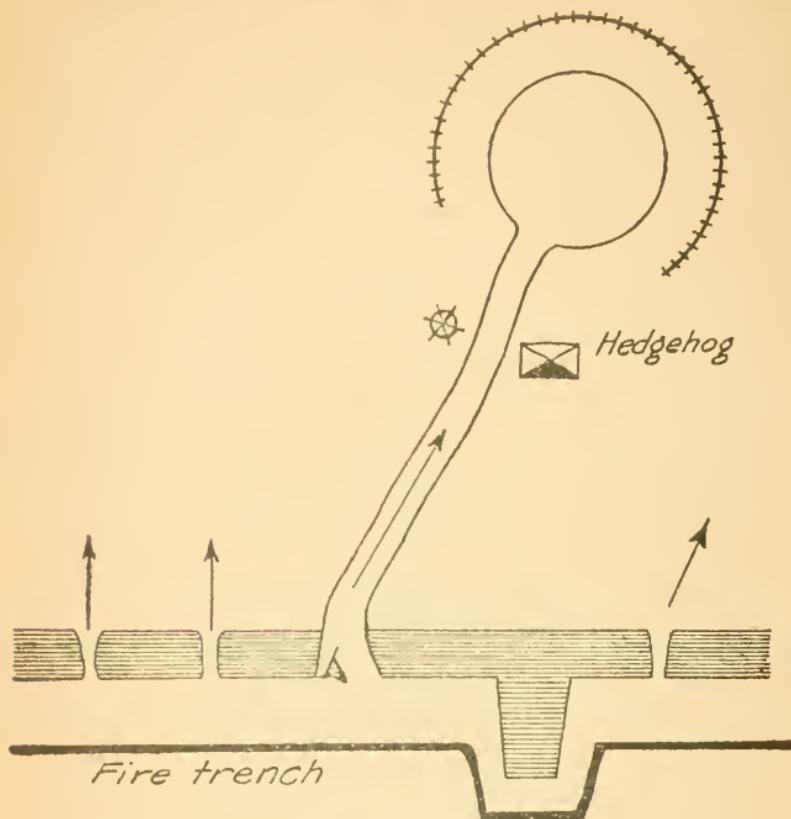


FIG. 9

The officer sending out these patrols determines the time and the point at which they will leave the lines (through the hidden passages prepared in the barbed wire, or from a listening post the itinerary and the probable time and point at which they will return to the lines. In order to avoid mistakes, all this information is given, at the prescribed time, to the watch officers, non-commissioned officers and to the neighboring companies. Notice is also given to the lookouts that the patrol may be obliged to fall back by an unexpected route.

The leader of the patrol must have a luminous compass. He places his men at varying distances according to the darkness

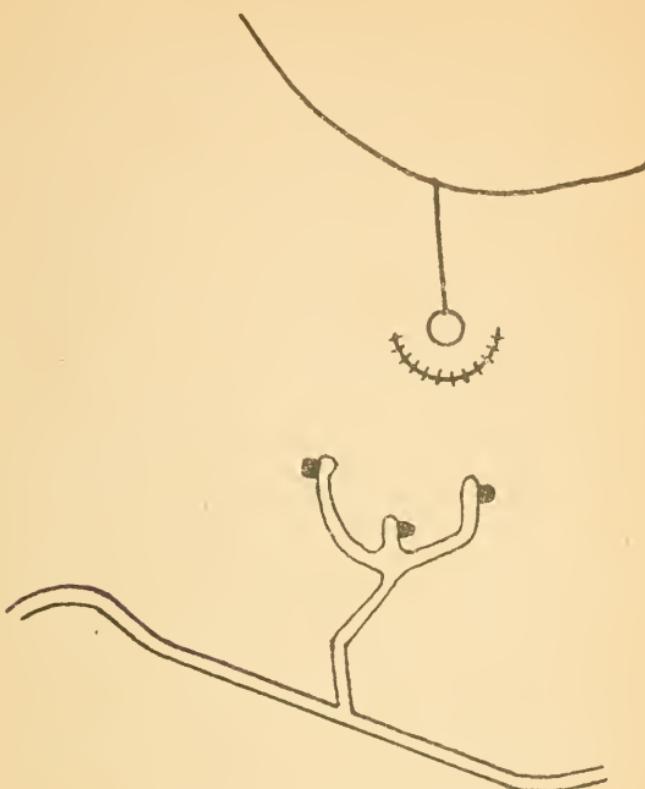


FIG. 10

of the night, so as not to lose them. Before departure, he examines their equipment to see that it makes no noise. He communicates to them the mission and orders governing the conduct of the individuals and arranges a few very simple signals to be used. He may make provision for a few rockets fired at stated intervals to light the way and guide the patrol's return.

Night patrolling is preceded by minute and detailed observation conducted during daylight.

Patrol duty is an excellent means of elevating a soldier's courage. Volunteers should be called for in exceptional cases only.

18. *Organization of and necessity for harassing fire.* The purpose of observation in the trenches is not only to give warning when the enemy leaves his trenches, but continuously to watch for every detail which may take place within his defensive organization and take advantage of his slightest movement for inflicting losses upon him.

Fire for the purpose of wearing him down should be the constant object of all platoon leaders and troops, and should not

be slackened by fear of reprisals. *Trench warfare is not a suspension of hostilities or guard duty; it is a phase of the battle.*

Each of the enemy's companies, upon completing a tour of duty in the front trenches, should have suffered a loss of 20 men. The enemy should feel himself confronted with a vigilant hatred and should know that we desire no rest until he is defeated.

19. *Provision for defensive fire.* Habitually, only "active portions" of the firing line are occupied, but the platoon leader should arrange for the possibility of manning the whole line and to fire either through the loopholes or above the parapet.

A few traverses are loopholed for the interior flanking of the trench. Means for blocking it are prepared, and points at which communication trenches join are to be especially defended.

A loophole should always be examined to determine the following conditions: that it is not obstructed; that its direction is well chosen; that it readily permits the ground to be swept by fire, and that it is suited to the size of the man.

The cleaning of a trench or of a communication trench will often cause loopholes to become too high above the bottom of the trench. In this case, new loopholes must be prepared, or a step made. Loopholes are allotted to those occupying dugouts in such a manner that the man lying nearest the outside of the dugout runs to the farthest loophole.

20. *Establishment of liaison.* Liaison between the platoon leader and the captain is maintained by runners (liaison agents), or with signal flags. The company should have two 14 cm. searchlights to supplement telephone communication with the battalion commander or with a neighboring company.

Every telephone line should be supplemented by visual signalling, which should be provided for in the plan of defense, and which should be tested once each day (for example: to report one of the daily statements).

Station calls of the neighboring posts are obtained. Touch should be maintained with neighboring stations by calling their station signals. *Although mechanical means may fail under certain circumstances, this does not excuse a commander for remaining in ignorance of important changes in the situation of his unit nor for not having exerted his personal efforts in directing the events.*

21. *Organization of the works.* The platoon is always responsible for keeping in condition the trenches and communication trenches it occupies, and for the constant improvement of accessory defenses and for the construction of new works.

In addition, the captain allots among the platoons the maintenance of communication trenches at the rear and the general fatigue work in the strong points. For these duties support platoons are usually employed.

The duty of the platoon leader is to divide the whole work among small parties, with a leader for each. This leader is responsible for the execution of his well defined task. The platoon leader shows him during the day what he will have to do at night, and has him establish all marks necessary to find his way in the dark. He must also have wooden measures, which are necessary to verify dimensions.

*Liaison with the neighboring platoons.* In order to develop cohesion, the platoon leader must be in constant and personal touch with the leaders of neighboring groups, with the trench mortar party, and with the engineers working at the strong point, etc. He inspects observation posts pertaining to his own sector and to the sectors of adjoining units.

In order to be able to devote most of his time to tactical requirements, he requires his non-commissioned officers to familiarize themselves thoroughly with all details of trench duty for which they are responsible.

#### DETAILED DUTY IN THE TRENCHES.

23. *Reliefs.* When the platoon arrives, each group takes its place; the observers, the advanced posts, and the non-commissioned officer on guard proceed to carry out the orders for the night.

The platoon leaders and the commander of the outgoing company withdraw only when their duties have been taken over and when they are notified by the incoming company commander that their services are no longer needed. The incoming leaders then become responsible and report to their immediate commander that the relief has been completed.

Should the enemy attack during the relief, the outgoing commander retains the command.

*Leaving the trench.* Have the men of the outgoing units prepared before the hour of the relief. All portable tools and camp material are taken. Grenades and cartridges in excess of the regular number carried on the person are left in the trench. The trench is inspected to be sure that nothing has been forgotten. The trench, the shelters and the latrines are left absolutely clean.

24. *Irregularities noted during reliefs.* In their haste to leave, officers of the outgoing units give incomplete statements of the orders. The incoming non-commissioned officers content themselves with replacing only the sentries and send the men into the dugouts; they do only what is indispensable. The information given to incoming units is very indefinite and often consists merely in indications as to the degree of the enemy's activity. Consequently poorly informed and oriented, the new garrison is for a time exposed to attack and sometimes even fires on a portion of its own line.

25. *Duty during the day and during the night.* This can be very readily determined by inspecting the sketches included in the orders for each combat group (See above.).

Night and day one non-commissioned officer from each platoon and one officer (platoon leader) from each company are detailed for watch duty.

26. *Schedule of duties.* The platoon leader makes the roster for the men not on duty. He orders certain ones to rest in the dugouts, while others are detailed for different duties which he prescribes, or which are prescribed by higher authority. It is thus always known who is on watch, who is sleeping and who is working.

27. *Inspections.* Inspections are for the purpose of co-ordinating and verifying the performance of duty throughout the company. They are made by officers and non-commissioned officers (particularly by those of the support platoons). The company commander orders the number of, and hour for, these inspections and a report is made after each inspection.

28. *Alarm.* An alarm is frequently given to be sure that everyone reaches his place rapidly and knows his duty. It is the best means for finding out the weaknesses. Every day an alarm is given before daylight, followed by roll-call. Likewise, a gas alarm is given.

29. *Dress.* The helmet must always be worn; the gas mask must always be in the alert position; the men must always be under arms, tools on the belt, the pack, canteen, blanket, etc., set in order in the dugouts.

30. *Rifles.* In the first line trench, the rifle is never put aside. It is always kept at hand even during meals. In other trenches, gun racks may be established near each dugout door, or in the dugout. If a man leaves a dugout, he carries his rifle. It is forbidden for anyone to be in communication trenches without his rifle. During the night each man must keep his rifle beside him in the dugout.

Rifles are never left in loopholes, except those mounted on stands. They are removed when a bombardment is expected.

It is forbidden to put into the bore any kind of paper, cloth, wood or grease.

To avoid accidents and wearing out the main spring, the rifle is never kept loaded; but the magazine is always filled. The cut off will always be up and the safety lock at ready.

Rifles are cleaned, oiled and inspected daily. All the rifles in one group are never taken apart at the same time. All rifles must be thoroughly cleaned immediately after every gas attack.

31. *Cartridges.* Cartridge niches in the parapet must be waterproof, and their location well known to everyone. Only a few clips are kept outside the boxes. It is strictly forbidden to stick cartridges in the ground.

Empty shells are collected in every platoon and sent to the material depot of the company.

32. *Grenades and rockets.* They are placed in cases, if possible covered with zinc and well protected against the weather. Smaller niches large enough to hold a sack of ten to twenty grenades are established at various places in the trenches, behind the barricades, in the dugouts, etc.

Only one variety should be placed in a single niche. Signalling fireworks and flares must not be placed with other ammunition and priming devices.

Moreover, since colored fireworks (green or red) contain chlorate compounds, which under certain conditions may act as a detonator, they must be kept separated from other fireworks or flares.

As a rule, it is best to put the cartridges and grenades in sandbags. Each sandbag will conveniently hold the following number:

Cartridges, 256 in each bag, weight  $16\frac{1}{2}$  lbs.

Grenades, F1, 10 in each bag,  $15\frac{1}{2}$  lbs.

Grenades, OF, 20 in each bag, 13 lbs.

Grenades, AB 1916, 6 in each bag, 9 lbs.

Grenades, VB., 10 in each bag, 11 lbs.

Each man can carry one of these sacks in addition to his regular equipment.

Men detailed for supplying ammunition, tie together two to four sacks, thus making a load which can be slung on the shoulders or arms.

This system is as well suited for troops stationed in the rear as for troops in the firing line.

During the night each lookout arranges the grenade bag so as to have it open at his side, after having rolled back the mouth of the bag. In the morning, after all danger of surprise is past, the bag is replaced in the niche.

A few grenades are fired from time to time in order to verify their state of preservation.

33. *Material depots.* As a rule, only one material depot is kept in a company (near the command post of the company commander); but to avoid all waste, the leaders of platoons or groups must have all tools placed at their disposal and all trench material not in actual use, kept in a small depot.

A company depot should contain a minimum of 500 grenades distributed in sandbags as explained above.

34. *Prevention of waste.* It is necessary to suppress severely all carelessness which causes waste of material, and it must be made clear to everyone that carelessness and individual waste can cause such demands for replacement that all production at the rear would fail to meet the requirements. All forms of waste must be severely suppressed. It is a proof of idleness and lack of discipline.

The following wastage occurs, which must be prevented by the means indicated:

Ammunition deteriorates by being left in the rain, it is lost in the mud or in shell holes; bayonets and rifles that have been damaged are oftentimes used as supports, packs are employed as sandbags and numerous other careless uses are made of valuable articles. These conditions must be avoided by the following means:

All material that has become unserviceable, all metallic pieces, leather, etc., must be collected in every platoon and sent daily to the company commander's depot. Particular attention must be given to recovering used telephone wire.

Fatigue parties must search abandoned trenches for and recover all loose property.

Abandoned property (such as tools, ammunition, etc.) found at any time by any soldier will be promptly turned over to a company officer.

35. *Rations.* At a fixed time, but depending upon the activity of the hostile artillery, a kitchen police detail leaves the trenches under the command of the Mess Sergeant or other suitable non-commissioned officer.

Cooked food is distributed at the field kitchen, which is attended by another non-commissioned officer of the company who has remained with the combat train to receive the food and see that it is properly cooked.

The distribution having been made, the party takes the rations up to the trenches under the control of the non-commissioned officer. The latter has the party take back unserviceable material, empty cartridge cases, and the weapons of the killed and wounded. These articles are turned in at the proper depot. The above non-commissioned officer reports to the company commander the return of the party to their platoons.

The platoon leader makes every effort to heat the soup and the coffee (charcoal, faggots, etc.). He inspects all mess tins. He should bear in mind that palatable food for men serving in the trenches is a most important means of favorably affecting their morale.

36. *Platoon leader's memorandum.* He is responsible for the defense of his sector, which he must hold at any cost.

In order to execute his mission, the following details demand his attention:

Duty of his group, or of each of his combat groups, in the general defense.

The orders and the plan of action, which must be kept up to date.

Observation, Inspection, lookouts.

Details for day and night duty, the non-commissioned officer on watch, inspections, patrols.

Defensive and harassing fire.

Flank protection for the front and interior of the position.

Repair of loopholes, serviceable condition of weapons and ammunition, grenades.

Accessory defenses, openings, mobile defenses for blocking the communication trenches.

Liaison, rockets, signals.

Neighboring machine guns and trench mortars.

Repair of fire and communication trenches.

Improvements in trenches and dugouts.

New works to be constructed.

Material received, surplus material, waste.

Precaution against gas.

Alarm drill.

37. *Half platoon leader's memorandum.* List of men for various duties. Calls.

Assembly and assignment of fatigue parties.

Allotment of men to dugouts; arrangement of their equipment, and straw.

Cleanliness of the trench and the dugouts.

Removal of mud. Drains, sump-pits.

Burial of refuse. Measures against rats, particularly forbidding the least particle of food to be thrown on the ground or outside of the trench.

Latrines—digging and cleanliness of; daily disinfection.

Sign cards, telephone wires, care of all classes of fittings.

Prescribed uniform (watchmen, fatigue parties in dugouts) wearing of the helmet, the rifle, the gas mask, and the portable tools.

Daily inspection of arms and ammunition.

Equipment, camp material, tools, reserve rations.

Warming food, making equal distributions.

Sickness, soldiers excused from duty.

He makes known to the men the command post of the platoon leader and the captain, the battalion first aid station and the directions given regarding passage in the communication trenches.

He must be able to take the place of the platoon leader.

38. *Memorandum for the non-commissioned officer on guard.* Exact duties of the combat groups within the platoon and of neighboring groups. Ground to be covered when firing; aiming marks for night firing.

Imparts to his men above information.

Keeps the flare pistol and fires it if a suspicious noise is heard.

Verifies the condition of the loopholes.

Sees that the lookouts are alert, rifles loaded, sound apparatus ready for gas alarms.

Verifies the orders, written or verbal, which lookouts give to one another.

He is informed of the time of departure and return of patrols; their itinerary, which he makes known to the men.

Reports to the officer on watch and to the platoon leader each incident and the arrival of a superior officer.

Gives to his successor the written orders and the panoramic sketch of the hostile line under observation. Submits these matters to the platoon leader, so that they may be kept up to date.

39. *Memorandum for company supply sergeant or first sergeant.* Receives from the supply sergeant of the outgoing company the statement of the material to be taken over (including the material that may be in the platoons.)

Verifies this material, and obtains the receipt of the company commander.

Supervises the depot of material, keeps an account of everything coming in, going out, and consumed.

Stands ready to fire signal rockets at the captain's order.

Prepares the necessary periodical reports.

Identifies corpses, strips them of personal belongings, which he lists and turns over to the designated officer. Leaves an identification tag with each corpse and, if directed, supervises the burial of bodies according to instructions on the subject.

If directed, takes from slightly wounded, whatever articles are so ordered, but allows them to keep gas mask, equipment, one day's ration.

Turns over to the proper officer all unserviceable material collected.

40. *Memorandum for the battalion sergeant major.* To take charge of the property pertaining to the command post of the battalion commander.

To acquaint himself with all of the established methods of liaison (telephone, radio, visual, runners, etc.).

To make the arrangements prescribed by the battalion commander for firing the signal rockets.

To familiarize himself with the periodical reports and returns and other official papers; to request them from the companies in due time; to require the companies to furnish duplicate lists of the property with which they are charged; to consolidate every morning the requisitions for supplies.

To co-ordinate the services of the liaison agents and runners; to keep them posted as to the location of all the command posts and the available routes thereto (colonel, adjacent battalions, companies, battalion and regimental first-aid stations, observation posts and telephone posts of the artillery).

41. *Memorandum for the company commander.* Responsibility for the defense of the sector.

Plan of defense of the sector. Sketch. Copy of the orders for combat groups. Employment of the various weapons. Use of signalmen.

Confidential documents kept in the trenches limited to the minimum; arrangements for their destruction prior to an attack.

Good condition of trenches; selection of the officer on watch.

Inspections to be prescribed. Suggestion about patrols to the battalion commander.

Study of the possible perfection of his plans for defense and counter-attack, and the material welfare of the men in the trenches.

• Selection and strengthening of observation post.

Location of the command post, the telephone, depots of ammunition, water, rations, and supplies.

Study of raids that are possible and the best employment of the trench artillery.

Liaison by telephone, visual signalling, or by other methods, with the battalion commander and the adjacent companies: liaison with the platoons; station calls of the several stations.

Personal touch with the trench mortars, machine gun units, engineers, etc.

Methods of calling for barrage fire or reprisal fire; rules concerning rocket signals.

Daily reports; observation of hostile artillery fire, origin, hour, calibre, points of fall.

Requests for material.

## Chapter II.

### INFANTRY ATTACKED IN ITS TRENCHES.

42. Units in the trenches may have to repel a surprise attack or an attack preceded by a violent bombardment. Either may be prepared by an emission of gas or by gas shells.

43. *Surprise attacks.* Surprise attacks, either by night or by day, have no hope of success unless the duties of the lookouts have been poorly performed, or the men have not been sufficiently trained in responding to alarms, or the accessory or flanking defenses are insufficient. The enemy will then take advantage of the confusion to which even good troops are liable when they are too confident about their own safety.

The remedy for all this is to keep the troops in the trenches always in the atmosphere of combat by causing them to actively wage a harassing warfare. If the enemy is constantly annoyed and deprived of his rest, he will not fail to understand what is likely to await him if intact trenches are attacked.

44. *Attacks after bombardment.* The attack comes most often after a shelling of extraordinary violence. It is delivered against all the lines and communications of the first position. Before each assault there is a heavy concentration of fire on the first objectives assigned to the infantry and a barrage fire behind these objectives. The heaviest shells may be employed against the first line trenches. After a few hours, or even after a few days, the enemy will judge that the accessory defenses are destroyed, that the trenches are levelled, and that the few shelters remaining intact contain defenders who are quite demoralized.

When he judges this to be the situation, he will lengthen his range, while still continuing the barrage, and his infantry will come rapidly out of the trenches, following closely behind the barrage and will reach our line.

Numerous resistances, *victorious in spite of the most formidable attacks*, have proved that *brave defenders in small numbers can still occupy their ruined trench and stop the assaulting enemy.*

What the most powerful artillery has failed to realize is that even though the means of defense and the morale of its defenders may be diminished, their complete destruction cannot be accomplished.

The resisting capacity of the real soldier remains always superior to material conditions.

Every man must endure shelling with stoicism, and be made to know that, if he escapes, he can *certainly*, with the aid of a few comrades and undamaged machine guns, sweep the enemy's waves of assault, provided he is in his fighting position at the proper time. If the fighting position is destroyed, a shell hole will be chosen to protect him while accomplishing his mission.

45. *Importance of good lookouts.* All depends on the efficiency of the lookouts.

They must give immediate warning when the assaulting line shows itself; and the men must leave their shelters, with rifles loaded and grenades ready, before the enemy reaches our lines.

It is a question of seconds not of minutes.

The following rules should be observed;

(a) *Every shelter must have a lookout in the immediate vicinity, who is able to be seen and heard from the entrance of the shelter.*

(b) The lookout post, built at the same time as the shelter must be protected as strongly as possible.

(c) The lookout, who in turn is watched by a man as relay placed at the entrance of the shelter, *must be relieved as often as necessary.* (This post being dangerous, every man in the shelter should take his turn.)

In addition to the lookout, a large periscope is installed, if possible, and worked from the interior of the shelter; but the periscope alone would be uncertain.

Reliance should not be placed on any signals, bells or wires of any sort, for the giving of an alarm by a sentinel placed at some distance from the shelter.

These rules must be adhered to for dugouts and machine gun emplacements. Occupants of the latter must be moved from the "rest shelter" to the "alert shelter" at the beginning of the bombardment.

46. *Liaison under shell fire from first line platoons to the captain and battalion commander.* The telephone must not be relied upon, for the wires will usually be cut.

Visual communication is unreliable, due to the wrecking of the first line trench and to the huge dust clouds floating about it. Liaison may be renewed after the *assault*, with the aid of searchlights kept till then in bombproof shelters; but reliance must not be placed on this kind of communication for announcing the assault.

Runners are the only means of communication which are reasonably certain; but such men are costly and slow. Runners must be reserved for a crisis.

It is only the runner who can bring a small sketch of the situation to the higher commander, who awaits it with impatience. A judicious use of fired messages economizes the strength and the lives of the runners.

*Rockets* are the best means of immediate communication. They must be placed beforehand in available shelters; but it will generally be difficult to use them satisfactorily in the first line, the rapidity of the assault often preventing their use. At any rate the lookout should be placed in position to fire the signals calling for a barrage (rockets or rifle grenades) and he should be instructed to fire them as soon as he sees the assaulting line emerge from the hostile trenches.

The best solution of communication is to have the command post of the captain and battalion commander provided with armored observation posts. They should be so located that the observers at these observation posts can perceive the launching of the assault at the same time as the observers of the first line.

47. *Launching of counter-attacks. Action of the supporting platoons.* The captain may immediately launch his counter-attack, a movement which must be studied and decided upon beforehand and details, as far as may be foreseen, worked out; but the execution of this movement would be dangerous during shelling, and before the barrage has lifted.

*The leader of a support platoon must not wait for the captain's orders, if all communication with his captain is broken.* If he learns otherwise than through the captain that the first line has been penetrated, and he can get no orders from his captain, he must execute upon his own responsibility the counter-attack previously provided for.

In certain cases the leader of a counter-attack platoon should detail a liaison agent in the main fire trench, or even establish a chain of runners, in order to be promptly informed as to the time for launching the counter-attack, without having to rely on indirect information from the company commander.

In case nothing is seen from the captain's observation post, and all communications with the captain are cut off, while the battalion commander alone perceives the enemy's rush, the battalion commander must then send one or two of his reserve platoons, fully prepared in advance for this emergency, to execute or reinforce the counter-attacks which were assigned to the support platoons.

48. *Use of barrage fire.* Although the defenders of the first line groups are in position to sweep the first assault waves, it is further necessary to warn the artillery that the time has come for a violent *barrage fire* behind these assaulting waves.

This barrage is for the purpose of cutting off the assault waves and preventing any support, supply or retreat.

Thus isolated, they are at our entire mercy, even though they may have entered our first line and support trenches. Their initial success will cause them to be engaged against certain parts of our position (Figures 11 and 12), but they will be a prey to front and flank fire, even before the delivery of counter-attacks.

Officers must explain to their men — not by theory, but on the ground they occupy — these principles of barrage fire and the system of partitions of their position. The officers must show the men why they should not be influenced by the first disagreeable impression, when they see behind them an enemy who has broken through the lines to the right or left of points they still occupy; for the enemy still has on his flanks *à droite*, works that are intact. His local success has in reality shut him in a "fire pocket" from which he will not be able to escape, unless our men become discouraged.

The tenacity of a few men, even though completely encircled within their combat groups, will bring victory.

49. *Setting up the barrage.* Barrage fire is requested by every command post as soon as it is informed of the launching of the enemy's assault. It is requested by telephone, or, if the telephone is cut off, it is signalled for by rockets.

*Each line must repeat, one after the other, the rocket signals seen in front until the barrage fire commences.*

In default of other information, the captain and the battalion commander ask for the barrage and launch the counter-attacks as soon as they perceive that the range of the hostile artillery has been increased and that rifle fire is being delivered against our first line.

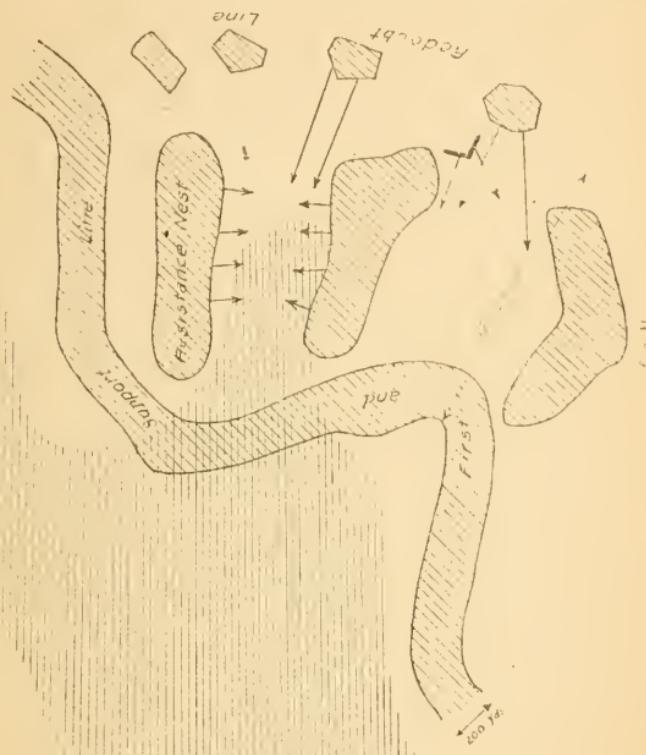
If shelling is localized on the front of one or several of the supporting points, the adjacent points must be ready, in case of imminent assault, to warn the artillery concerned by their own telephones, which have probably remained intact. These lateral communications and observations, although indirect and longer, are invaluable if the direct means have failed.

*Carrier pigeons* are influenced very little by heavy shelling and may also be employed. Since the bird returns to a central loft, the message must state exactly from which artillery group the barrage is asked, and on which part of the front it is required.

*Signals between ground searchlights and airplanes* are employed when possible and will conform to the regulations and methods mentioned in *Liaison for All Arms*.

In foggy weather particular attention must be given to liaisons. Visual posts and the rocket relay stations must be brought closer together; sound liaison (bugle) must be used. In the fog the bugle may be sounded outside the trench, thus considerably increasing its range.

50. *Counter-attacks.* Counter-attacks are attended with greater success and less loss the sooner they are launched. They should take the enemy by surprise, and before he has recovered



from the effects of his first contact and has re-adjusted his formations. They should be made upon the initiative of local commanders, for the chances are that the transmission of orders and intelligence will have become most difficult. All hesitation or delay will be dearly paid for.

The commander provides for this beforehand, but it is practically the enemy himself who gives the signal for the counter-attack.

The counter-attacks must act like two jaws of a trap which close automatically, as soon as the animal has set foot on the spring.

51. *Direction of the counter-attacks.* Although they may be frontal, as in the case of a support platoon, still the best results

are obtained by acting simultaneously on both flanks and along the first line. By a progressive attack with grenades in the main, cover, and support trenches and along the communication trenches, the enemy is taken in rear, his retreat is threatened, and those who have managed to break through are surrounded.

Thus to meet the assumed case of a hostile penetration between C. and D. (Figure 12), the following counter-attack should be made: barrage in front of CD by artillery; a column of one or two platoons to emerge from the group of intrenchments G, and to attack in the direction from north to south; a similar column to advance from supporting point H, to attack in the direction from south to north. Plans for counter-attack to meet various situations will be carefully studied in advance by the commander of the strong point.

52. *Reconstruction of destroyed trenches.* After a hostile attack has failed, it must be remembered that another attempt will probably follow in a short time. Work upon the destroyed parapet must be begun immediately. Sandbags and trench shields permit of hasty provisional reconstruction.

53. *Menace of mines.* Wherever the presence of a hostile

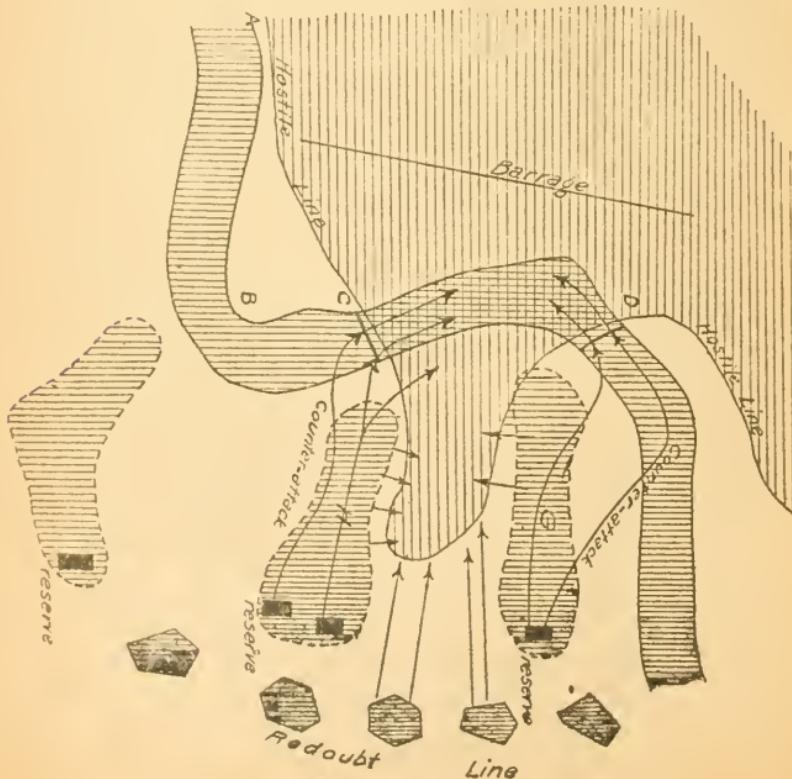


Figure 12.

mine chamber is suspected (sound heard for a considerable period, then suddenly ceasing), plans must be made to occupy the crater before the enemy does. When, in the judgment of the engineer officers, the gallery has reached the point marked Mine (Figure 13), and the mean diameter of craters in that region is from 35 to 45 yards, two trenches are established AB, and BC, 10 to 15 yards outside of the probable perimeter of the crater. The menaced trench is abandoned, and preparations are made to rush from AB and BC to the nearest edge of the crater.

From there the enemy can be prevented from occupying the crater. It is dangerous for defenders actually to occupy the crater, since the enemy often has a second mine ready, or can easily prepare one shortly with his undestroyed galleries, even though those under the crater are destroyed. It is well also to place a couple of machine guns to fire toward the listening post along the edge of the crater and trench mortars to cover the interior of the crater with curved fire.

54. *Men on special duty and fatigue parties surprised by an attack.* Isolated men, supply columns or laborers surprised at some distance from their unit, must place themselves immediately

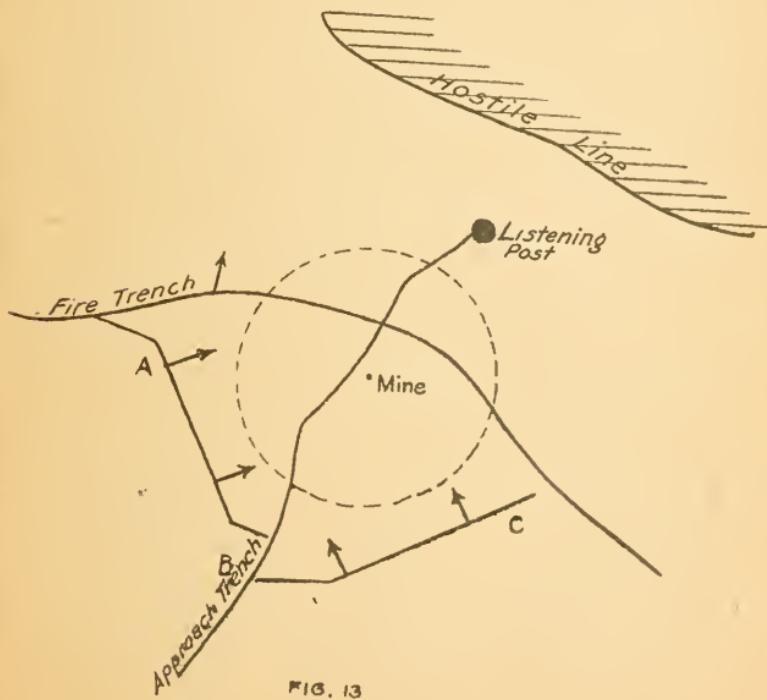


FIG. 13

under the commander of a neighboring unit, and remain at his disposal. The commander will incorporate them in his own unit, or will have them sent back to their unit by a non-commissioned officer bearing a written order.

55. *Details surprised in their shelters.* Cave shelters afford protection from intense shell fire, but their disadvantage is in hindering rapid exit. It must be foreseen that the enemy may be found at the outlet of the shelter when attempt is made to reach the fighting position. Each shelter must have on hand a small supply of grenades to be used for clearing the exit by force. Every man must be determined to act thus, and not to allow himself to be killed or asphyxiated by the enemy. Alarm must not be felt over the fact that the enemy has crossed the trench; others will take care of that. Those of the enemy already in the trench must be exterminated, in order that occupants of dugouts may occupy their positions for firing on the second and third waves.

56. *Tenacity of the defenders.* Each defender must be resolved to fight till the end and *not give up the fight, even though he believes those nearest him are overcome*; for beyond his neighbors there are other soldiers who still hold on and who will come to his help. A combat should never be judged by what is seen in the immediate vicinity, but each individual must feel entire confidence in his battalion and regiment.

*Not an inch of ground should be voluntarily given up, no matter what the circumstances may be. A unit, even though surrounded, must resist to the last man, without falling back; each man's sacrifice is the price of victory.*

## Part III.

### ELEMENTARY SCHOOL OF THE ORGANIZATION OF THE GROUND.

#### INTRODUCTION.

1. *Camouflage.* The importance of concealing the elements of the defense (see Chapter I, Part I), has caused the art of so locating, designing and constructing works that they will escape detection, to become highly developed in the present war. This is called camouflage. When taking up positions in open warfare, natural and artificial cover (embankments, ditches, roadcuts and fills, villages, woods, hedges, vegetation, etc.), are utilized to the fullest extent for developing the fire power of the defense and concealing and protecting the men. Shelter from shrapnel and rifle fire (detached elements of standing trenches) are first constructed for the protection of the men. As soon as possible, these are connected up by a complete system of trenches, and the disposition of troops therein kept concealed from the enemy.

2. The following principles of camouflage should be known to all:

(a) Never, where it can be avoided, change the *form* or *appearance* of an existing terrain or construction; if it must be changed, always restore it to its original appearance (color, sod, vegetation, etc.)

(b) Do away with all possible causes of shadow; reliefs should be suppressed by very small slopes; conceal all orifices (entrances to shelters, shafts, loopholes, etc.). *Most works are revealed by shadows.*

(c) Works are also revealed by smoke, light, gun flashes, reflection from periscope mirrors or other shining objects, etc.

(d) Concealment of the work should begin with its construction and the work being done kept concealed. (Screens, branches, etc., over excavated earth.)

(e) Camouflage should be maintained: that is to say kept in harmony with the adjacent ground (example; green branches with leaves turning yellow.)

(f) Bad camouflage is not only useless but harmful.

3. The following materials are used for camouflage: sod, long shrubbery, branches, raffia on wire netting, painted canvas, excavated material under temporary screens. Avoid regular forms, and netting that is not opaque. Pay special attention to edges of camouflage where it meets the ground.

Shell holes: retain the form; put a painted canvas at the bottom; occupy it only during an alarm.

Shelters: scatter the excavated material; cover with vegetable mold each morning if necessary to make it conform to surrounding terrain; above all conceal the entrance (screens.)

Narrow gauge railroads: cover with irregular branches, never with canvas or raffia curtains.

Trails: continue them past their destination; keep them from being widened near the work by a wire fence; they should not be numerous or converge near a command post; trails are visible in villages as well as in the open and may reveal a construction otherwise perfectly concealed.

Deceive hostile observation by making dummy works; dummy trenches, false entrances to shelters, piles of excavated material, trails, dummy batteries, etc. If the enemy fires on these, repair the damage so that the enemy will think them occupied.

4. Avoid betraying the location of the work in the following manner:

(a) A large amount of camouflage material has been prepared, but the work is begun before the camouflage is put in place.

(b) A work is well camouflaged but depots of material are left unconcealed nearby.

(c) A shelter is very carefully concealed, the excavated material is carried away at great pains, but a periscope is left unconcealed, or smoke issues from the interior, etc.

(d) A trail is used for approaching a command post or an observation post which terminates at same.

(e) One observes from the open near a post.

(f) Men do not keep concealed but move about when a hostile aeroplane is overhead.

The Camouflage Service contains specialists, who may give advice and furnish detachments to assist in important works. This service is small however, and its personnel is limited. All men should be trained in the principles of camouflage mentioned above. The Camouflage Service furnishes special camouflage supplies. Requisitions should be made to the division engineer.

5. *Importance of Field Works in Training and in Fighting.* The present war has put the *tool* on the same footing as the *rifle*. Nowadays, the *soldier* is at the same time a *combatant* and a *workman*; the one is no longer thought of apart from the other. He uses his *rifle sometimes*, his *tool everyday*.

When a soldier has conquered the ground at the cost of blood, if he counts only on his *rifle* to hold it, he will be greatly deceived. He must, as tired as he may be, immediately start digging; he must know that each shovelful lifted in spite of fatigue, is a check to the counter-attack which the enemy is preparing against him *at that very moment*.

For officers and non-commissioned officers to lead their men into battle is a relatively easy matter. But to get exhausted and decimated troops to work without rest or delay is a far more difficult task. It is, however, just as imperative a duty as the first; the smallest counter-attack may turn an apparent victory into a defeat, if the "digging to hold" energy does not immediately follow the energy to conquer.

Non-commissioned officers will make their work easier if they impress upon their men beforehand the above ideas which do not always appear to them quite obvious; they should not lose an opportunity to communicate to them instances of engagements that illustrate the penalty of carelessness and the reward of tenacity in the matter of field intrenchments.

6. Two principles must always be borne in mind:

(a) *Never delay starting a work because the necessary time for its complete achievement may be lacking.*

This principle is true under any circumstances: in fighting as well as in periods of stabilization.

(b) *In the fight, after an advance, the best means of reforming the troops consists in showing them the work to be done and ordering them to begin doing it immediately.*

The surviving commanders must be energetic enough to immediately assemble and co-ordinate the efforts after a fight in a manner which will conform to the requirements of subsequent operations and the preparation of the ground necessary for same. Otherwise, every soldier or small party wastes strength and time on individual undertakings. They dig where they find holes and bits of trenches which are of no use for resuming the advance, and in that way a battalion sometimes loses two or three days that could have been used advantageously for the following advance.

In order to thoroughly establish the second principle set forth above, it is necessary to prescribe that in instruction *every infantry maneuver should terminate in the laying out and construction of intrenchments on the last position attained.* Officers and soldiers will get into the habit of considering maneuvers and intrenching one and the same thing,—and as important in the plans of the command as any of the other operations. It is wrong to have separate maneuver and intrenching exercises. Intrenching is part of the maneuver just as extended order or assault drill. And whether on the offensive or defensive, there is no maneuver without intrenching.

7. The soldiers should be so instructed that even when the commander falls, their efforts will still converge toward the same ends. Every combatant should know that the hole he digs is above all a *fighting emplacement* and not merely a shelter; this emplacement should therefore be chosen so as to favor the use of his weapon and the co-operation with his comrades. This

*co-operation is facilitated by the continuous line; as soon as a man finishes his individual emplacement he should connect it to those adjacent to him. Those who are not in the first line work to establish communication with the more advanced troops. This method of taking possession of the ground by a continuous system of rapidly dug parallels and communication trenches is of capital importance. This should be understood by all and should be repeatedly taught to the men.*

8. *Classification of field works.* The following are some of the fundamental types of the elements of the organization of the ground:

I. Fire trenches and communication trenches;

II. Underground galleries;

III. Wire entanglements;

IV. Accessories of fire trenches and communication trenches. Troops should be familiar with the execution of these works. These constitute a sort of *manual of arms* for the organization of the ground and should be taught with the same earnestness. As in the manual of arms, a brief command should be sufficient for determining the execution. The dimensions given for the fire trenches, communication trenches, and entanglements are average dimensions that should be known by all and that we should try to get, but we should not seek an excessive exactness, incommensurate with the usefulness.

### *Chapter I.*

#### FIRE TRENCHES AND COMMUNICATION TRENCHES.

##### DEFINITIONS, DIMENSIONS.

9. A fire trench is a ditch organized for *rifle fire*.

A communication trench is a ditch organized for *circulation* and sheltered from the observation and, as much as possible, from the fire of the enemy.

Figures 14 to 19 give the profiles of the normal type of fire trench and communication trench and the nomenclature of the elements.

Lines parallel to the front are organized for fire over most of their length. They will therefore have the *fire trench* profile. Parts of lines parallel to the front that are not organized for fire, are simply used for *circulation*; these parts have the *communication trench* profile.

*Approach trenches* are invariably used for circulation. They thus almost always have the *communication trench* profile. Most approach trenches, however, have parts that are organized for fire; these parts have the *fire trench* profile; the parts of the approaches that have the *fire trench* profile also have the same width at the bottom as the remainder of the approaches, so that circulation is not hampered.

10. *Remarks on the Normal Fire Trench and Communication Trench Profile.*

(a) In the trench the elevation of 4 feet 6 inches between the interior crest and the banquette affords a good firing position for a man of average height.

(b) During its construction, the trench may naturally be used to a greater or lesser degree, depending on the degree of completion. An excavation of 2 feet 6 inches, together with the parapet, gives a total cover of 3 feet, which is suitable for firing from a kneeling position. This, however, is only one phase of the construction; except during a momentary halt, *the final aim is always to make the trench suitable for firing from a standing position.*

(c) The distance of 6 feet 6 inches between the interior crest and the bottom of the trench permits natural walking without being seen.

(d) The width of the trench at the ground level (2 feet) permits convenient circulation behind those on the banquette.

(e) The dimensions of the communication trench—7 feet of total cover—permit convenient circulation with good protection.

(f) Beams are *indispensable* for preventing the sides from caving in under the pressure of the excavated material; *a width of 1 foot 6 inches is the minimum.*

11. *Modifications of the normal fire trench and communication trench profiles.* The above profiles will often be modified, particularly with reference to the following:

Increasing the relief of the parapet so as to have a better view from the trench;

Decreasing the depth of the excavation (and consequently increasing the relief of the parapet) necessitated by the presence of water or rock near the surface;

Decreasing the width in very hard soil, which permits the trench to have steep sides.

Removing the excavated material from the edge of the excavation; trench without parapet, deep communication trench or the use of an underground communication trench (Russian sap), where it is especially desirable to avoid being seen;

Need of protecting certain parts of the communications from hostile view and fire (covered communication trench).

Using natural cover (ditches, slopes, shell holes, etc.);

Increasing the width of the evacuating ("out") approaches and decreasing the width and depth of the secondary approaches.

12. *Increasing the protection by the trace and by traverses.* The protection acquired by digging a fire trench or a communication trench is made complete by choosing a *trace* that will avoid enfilade fire, and by means of *traverses*. Traverses (Figure 20) are intended as a protection against oblique and enfilade

## STANDARD PROFILES.

## FIRE TRENCHES.

(The profiles shown below will also be used around traverses)

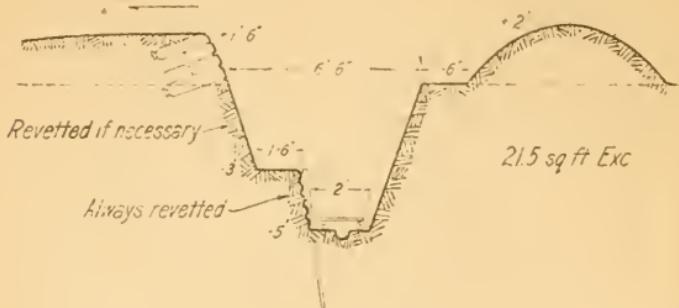


Fig. 14 TYPE A  
(For use without 'A' frames)

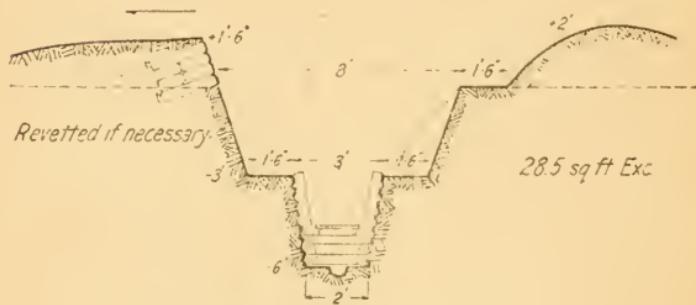


Fig. 15 TYPE B  
(For use with 'A' frames)

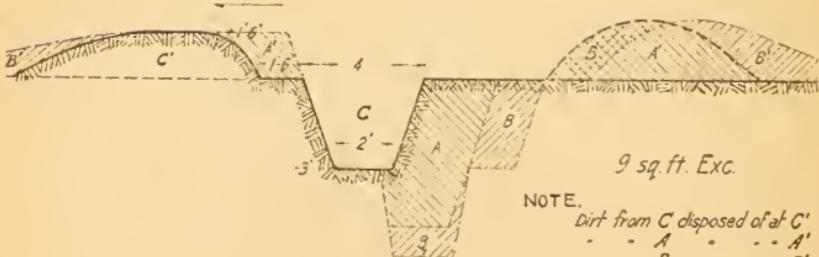


Fig. 16  
Simple Standing Trench  
(Showing development into Standard  
Fire Trench - TYPES A&B)

## STANDARD PROFILES.

### COMMUNICATION TRENCHES.

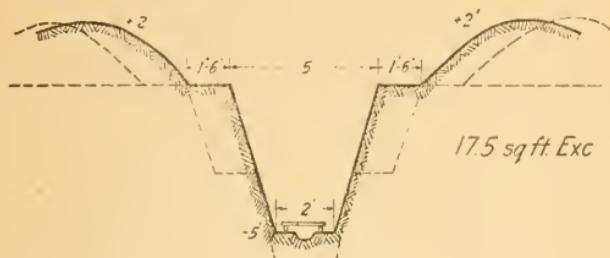


Fig. 17 TYPE A  
(For use without A frames)  
(Also shows development to TYPE B)

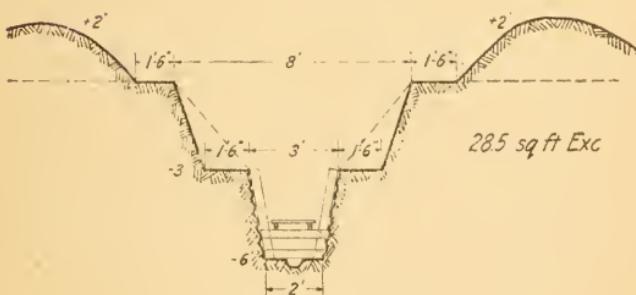


Fig. 18 TYPE B  
(For use with A frames)

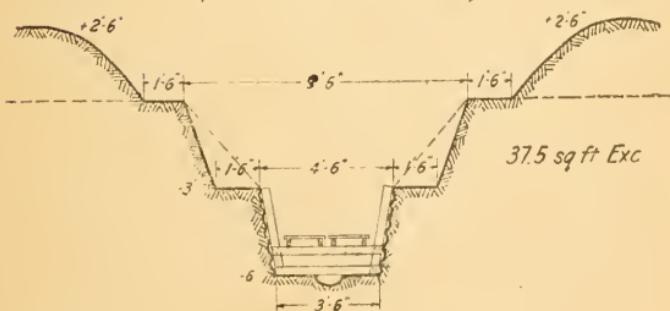


Fig. 19 TYPE C  
Broad Communication Trench

fire and to limit the effect of projectiles. They may also be used for the interior defense of the fire trench or communication trench.

Traverses afford good protection, but they hinder circulation. This is why they are used mostly in the trenches which are combat emplacements and very little used in communication trenches, which are used only for circulation. Traverses are spaced 40 feet apart from center to center, unless otherwise ordered. When exposed to enfilade fire, the distance from center to center is reduced to 8 or 10 paces.

### 13. Remarks:

(a) The thickness of the traverse at the ground level (12 feet or 4 paces) is the minimum that is necessary for protection, not only from oblique or enfilade fire but also from the explosion of projectiles falling into the trench.

(b) The length of the traverse at the ground level (12 feet) is such that the end of the traverse projects beyond the back of the reverse slope; this is indispensable for safely localizing the effects of projectiles.

## METHODS OF CONSTRUCTION.

14. There are two methods of constructing fire trenches and communication trenches—*working along the line* and *working from the ends*.

15. When *working along the line*, the work is begun for as great a length as possible, all the available men being deployed along the length of the trench and all working at the same time.

When *working from the ends* the trench is extended by working from one or both ends, by advancing foot by foot under cover of what has already been dug.

16. *Working along the line* is evidently the more rapid method; it will be used when out of the enemy's range and observation.

17. *Working from the ends* is a slow operation; but it permits working at points and at times when working along the line is impossible. When working from the ends, there are usually shifts, which relieve each other at regular intervals (every yard of trench). In this way each shift works at high pressure.

18. In zones swept by hostile fire, the two methods are used alternately.

### Examples:

(a) We hold the front A—B, and wish to establish ourselves at C—D (Figure 28). It is assumed in this case that working on a line is impossible during the day, but may be carried out at night, and that working from the end is possible during the day.

The work may be executed as follows:

## STANDARD TRACES.

Full lines indicate trace for Type B Trench.  
 Dotted . . . . . A . .

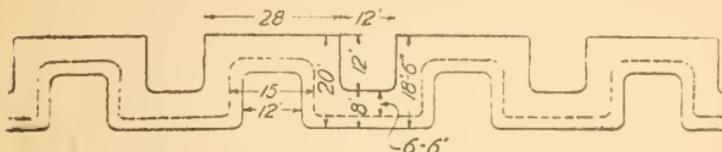


FIG 20  
TRAVERSED TRACE.

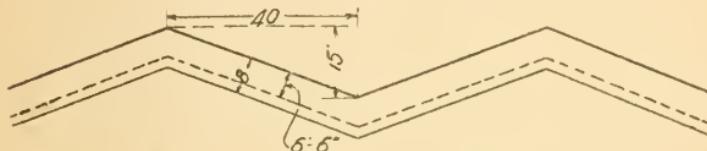


FIG 21  
ZIG-ZAG TRACE

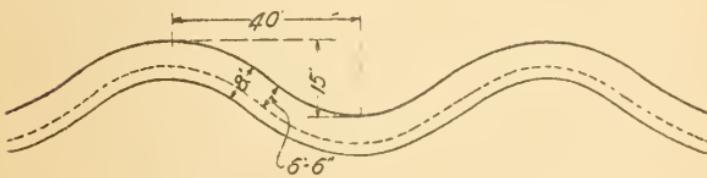


FIG 22  
WAVY TRACE.

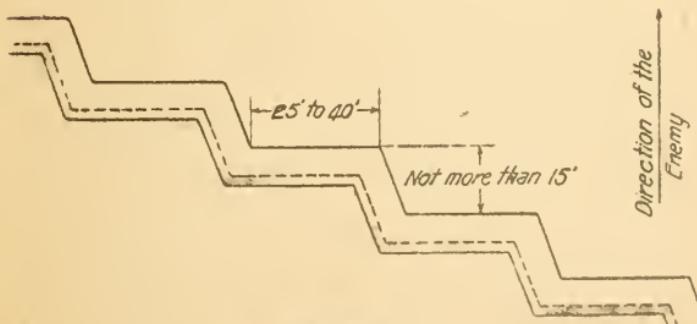


FIG 23  
ECHELON TRACE

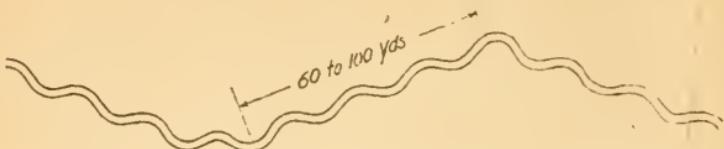


FIG 24

WAVY TRACE, RIGHT  
With both local and general irregularities



FIG 25

WAVY TRACE, WRONG

No general irregularities.

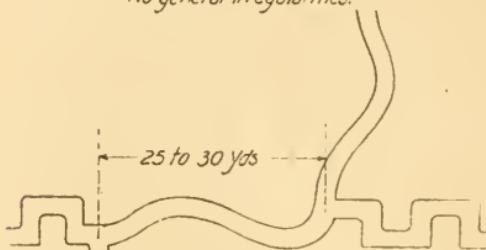


FIG 26

APPROACH CROSSING  
PARALLEL.

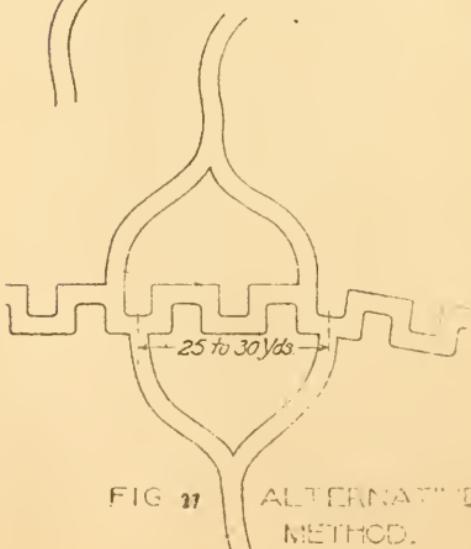


FIG 27 ALTERNATIVE  
METHOD.

*First night:* constructing, by working along the line, the approach trenches E F and G H, and the elements I J and K L of the parallel.

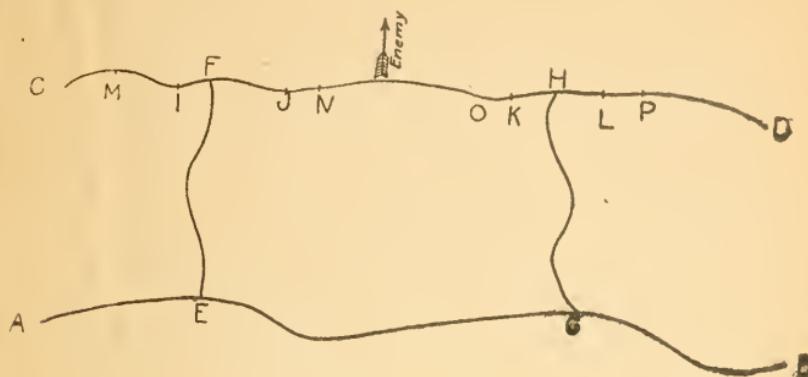


Fig. 28

*First day:* continuing the work of the first night by constructing the elements M I, J N, O K, L P (working from the ends, 4 shifts).

*Second night:* constructing the part N O (working along the line).

*Second day:* continuing the work of the second night.

(b) As another example we desire to construct an element of a parallel or of an approach trench A B (Figure 29) on ground where working along the line is too dangerous, even at night.

The procedure is then as follows: instead of beginning work on the entire length A B at the same time, we begin with small groups, such as squads, separated and working at 1, 2, 3 and 4.



Fig. 29

These groups dig themselves in as rapidly as possible by working on a line. Once they have a sufficient cover, each group separates into two parts which work at both ends of the excavation (working from the ends) under the cover already dug.

#### RECONNAISSANCE AND TRACING.

19. Excepting those which are executed by units engaged in combat, no work should ever be begun until it has been reconnoitered and traced. This is, in short, the *reconnaissance of the objective to be attacked*. Enough time should be devoted to it so that the men will be able to begin work without loss of time, without disorder, and without error.

20. The reconnaissance is made by the commander of the unit charged with the work, accompanied by the commanders of the subordinate units and men carrying 2 pick mattocks, stakes, cord, or tape. The diagrams are distributed in advance as far as possible.

21. Mark out the following with the pick mattock or cord:

The edge of the excavation nearest the enemy, together with the contour of the traverses, if it is a fire trench.

The center line of the excavation if it is a *communication trench*.

The limits of the excavation assigned to each unit.

Trace both edges of the excavation whenever possible.

Take advantage of darkness. When there is not sufficient time, the excavation may be marked by men who at night stand at the points assigned to them.

22. The following is an example of marking a trench on ground that cannot be crossed by day (Figure 30). A B is the front obtained at the end of the combat; it is in the process of organization; C D is the first parallel to the rear of A B. There is no organization between A B and C D and no distinct reference marks. The most urgent need is to insure communication from A B to the rear. It is decided to construct an approach trench beginning at E and ending approximately at F.

It is a problem of tracing the work of a company which should begin on the part E G. The following procedure may be used:

(a) In order to insure the correct direction to G, the direction E F is found by the luminous compass or by using a visible direction point.

(b) A white tape is prepared with marks E, a, b, c, d, G (such as knots of thread) at intervals of about 10 yards (E a, d G) or 20 yards (a b, b c, c d); prepare the necessary number of stakes (in this case, 6 stakes, white if possible).

(c) An officer and one man walk to G by means of the compass and at the same time unroll the white tape from E. A stake is set at G and the tape tied to it.

(d) A second officer or non-commissioned officer follows and unrolls a second tape. He is accompanied by a man carrying 4 stakes. On reaching a, he steps 8 paces to the right, to H, sets a stake and fixes the tape; he comes back to the first tape, follows it to B, steps 8 paces to the left, sets a stake at I, attaches the second tape there, and repeats the process until he reaches G. The trace is then finished. He comes back to E and brings the first tape with him.

23. *Remarks.* (a) There is, of course, nothing absolute about the figures given above. It may be advantageous, for instance,

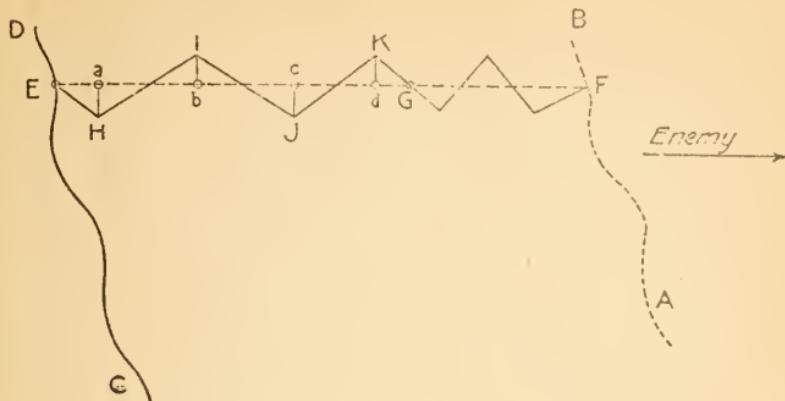


Figure 30.

in order to avoid being enfiladed, to increase the length of the straight sections H I, I J, J K, etc....and break the trace more by increasing the distance of the stakes H, I, J, and K from the line E F.

(b) The construction of the approach trench, which should be executed primarily for the purpose of securing communication with A B, will, at the same time, facilitate the reconnaissance of the ground between A B and C D and the marking out of the works which will be required on this ground. If, for example, it is thought necessary to make an intermediate parallel between A B and C D, it will be traced and executed much more easily when A B and C D are connected by approach trenches.

#### DIGGING THE FIRE TRENCH AND THE COMMUNICATION TRENCH.

##### WORKING ON A LINE.

###### 24. *Composition of the working groups:*

With park tools: 2 men (1 shovel and 1 pick mattock.) In very easily worked earth, 3 men (2 shovels and 1 pick mattock.) Each sergeant is in charge of several working parties and is supplied with some measuring device (usually a notched stick) and with a diagram of the proposed works when necessary. Corporals work with the men unless they are acting as sergeants.

*Length of the task.* The task assigned to each working party is usually based on 3 to 5 feet per man. For day work it may be reduced to one pace.

At times it may be advantageous to double the number of men in the working party and the length of the task without increasing the number of tools, one shift working while the other rests.

25. *Beginning and executing the work.* The officer in charge of work must see that proper security is provided. For this purpose automatic rifles are very valuable. A sentinel to give gas alarm must be furnished for each working party. The company is brought up in column of files, covering the trace from one of the ends or column of platoons or squads, covering the trace with the head of the column which later deploy along the trace. The greatest silence is observed. The platoon leaders make sure that all the working parties are in place, and then order in a low voice "Begin."

At this command each workman lays down his rifle and equipment on the side further from the enemy, when digging a fire trench, or on the side indicated by the platoon leader when digging a communication trench. Each working party marks the limits of its task with a pick and immediately begins excavating.

26. The excavation is always begun with a width slightly less than that desired. When completed, the walls are dressed up to the correct width. When working under hostile fire, go deep as rapidly as possible by beginning the excavation with a width sufficient for one man and then widening it.

#### WORKING FROM THE ENDS.

27. Working from the ends may be:

*In one stage*, that is to say, immediately excavating to the full depth.

*In two stages*, where the excavation is at first dug to only part of its final depth and completed by other workmen several yards behind the first.

As working from the ends is slow, it is accelerated;

By doubling the working parties;

By working two stages;

By using park tools.

28. *Working from the ends in one stage (Figure 31.)*

*Composition of the working party.* Each working party, consists of one non-commissioned officer, leader of the party, and 4 workmen grouped into two shifts which relieve each other every yard. For the work to be continuous, night and day, there is necessary 1 sergeant, 1 subordinate leader, and 12 men, thus making three shifts of 8 hours each.

In each shift No. 1 is the digger and No. 2 the shoveler; at each shift, they change their posts, No. 2 becoming No. 1, and vice versa. No. 1 is supplied with:

A short handled pick mattock;

A short handled shovel;

Measuring sticks for testing work.

No. 2 is supplied with an ordinary shovel.

The working party is, in addition, provided with: one extra pick, 1 extra shovel and 5 stakes.

**29. Procedure.** The sergeant in charge of the party sees to it that the trace is followed and that the dimensions are correct.

When beginning work, each shift marks with a stake the spot at which it began.

If the excavation has not been marked out beforehand, the sergeant marks out the center line of the element to be con-

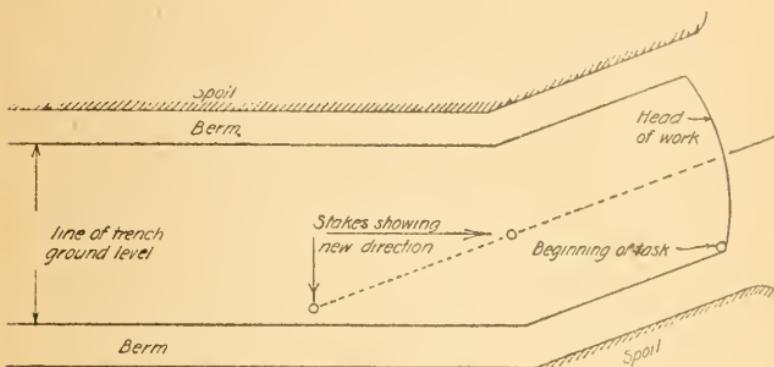


Figure 31.

structed by means of stakes set at the bottom of the trench (Figure 31).

No. 1 (digger) works at the head of the excavation. He digs it to the final width and depth. First, from a squatting or kneeling position, he digs two grooves to the depth of the pick-blade half-way up to the excavation, keeping in line with the two walls, preserving the banquette, if it is to be a fire trench; he then digs away the earth between these two grooves with the pick; he passes this earth between his legs by means of the short handled shovel and scrapes the bottom so as to keep the trench at the correct depth. He then digs the upper part of the trench by marking two grooves right and left up to the surface of the ground and digs away the earth thus undermined with his pick and passes it to the rear as described above.

He thus advances by elements of 1 to  $1\frac{1}{2}$  feet and, at intervals, verifies the dimensions by means of the notched stick.

No. 2 (shoveler) throws the earth on both sides and *is careful to leave the berms*.

Nos. 1 and 2 may exchange posts at the middle of this task.

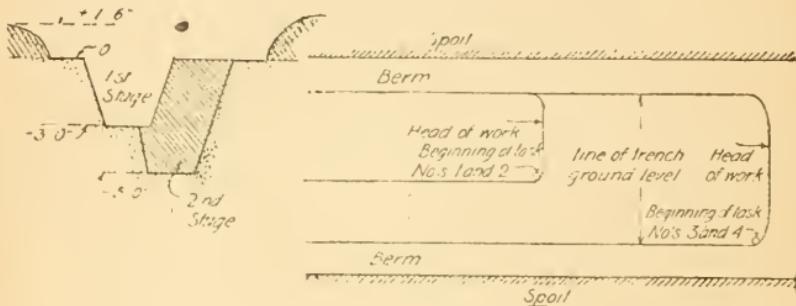
*Head parapet.* When in danger of enfilade fire, it is necessary to protect the head of the work by a head parapet of sandbags, gabions or metal shields. These are placed about  $1\frac{1}{2}$  feet in front of the head of the work by Nos. 1 and 2 and are pushed forward by hand or with the tools as the work progresses.

*Changing shifts.* As soon as one shift has finished its task of one yard, the sergeant in charge of the work orders "Change," and this shift lays down its tools and is replaced by the second shift.

30. *Working from the ends in two stages.* (Figures 32 and 33.)

*Composition of the working party.* Each party consists of a non-commissioned officer in charge of the work and 8 workmen, divided into two shifts which relieve each other every yard. When the work is to be continued by day and night it is necessary to have one sergeant, one additional leader, and 24 men, making 3 working parties of 8 hours each.

In each shift, the men are numbered from 1 to 4, Nos. 1 and 3 being diggers and Nos. 2 and 4 shovelers; at each shift Nos. 1 and 2 change posts with Nos. 3 and 4.



Figures 32 and 33.

Nos. 1 and 2 work at the head; they dig the first stage, 3 feet deep. They have the same tools as Nos. 1 and 2 in the case of working in one stage.

No. 1 is, in addition, supplied with a measuring stick.

Nos. 3 and 4 work three yards behind the head of the work; they deepen the first stage to the correct depth and widen it. They distribute the excavated material on both sides, being careful to leave berms of the correct width (1 foot, 6 inches). They are equipped with: No. 3, one park pick mattock; No. 4, one park shovel. No. 3 is also provided with a measuring stick.

Each working party is, in addition, supplied with 1 extra pick mattock, 1 extra shovel and 5 stakes.

*Procedure. Advancing the hand parapet, changing shifts.* similar to the procedure when working in one stage.

31. *Duration of work.* Table I gives amount of excavation which may be accomplished in various soils and proportion of shovels to picks required. Table II shows the time required for  $3\frac{1}{2}$  foot tasks and for 5 foot tasks for excavating standard trenches.

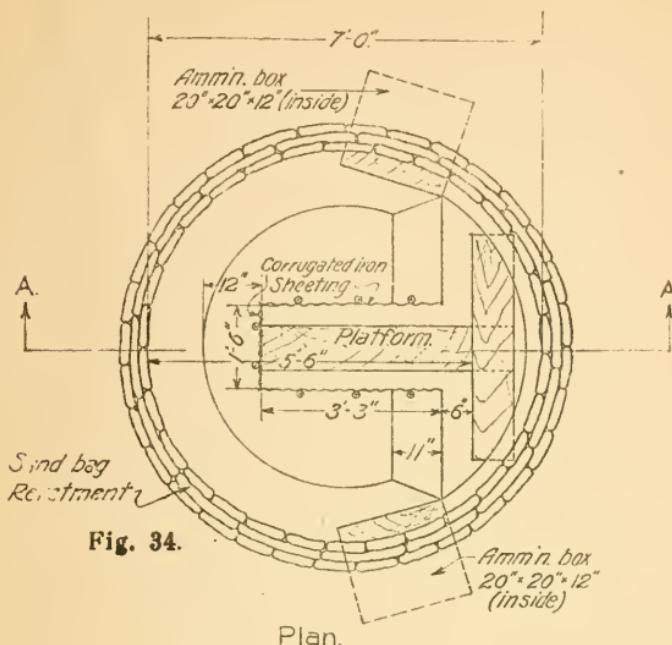


Fig. 34.

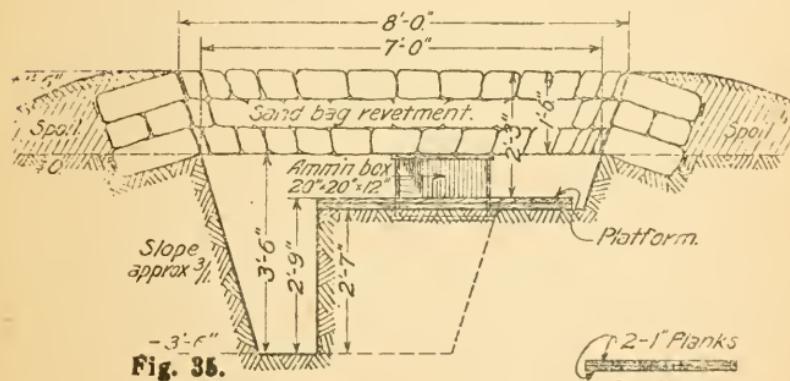


Fig. 35.

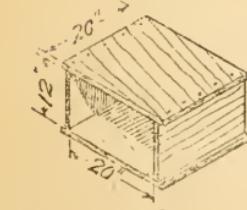
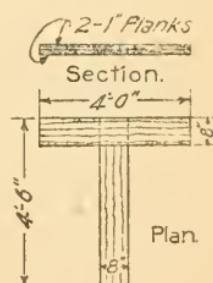
MACHINE GUN  
EMPLACEMENT.  
(Shell Hole Type)

Fig. 36.

TABLE I.

Nature of Soil	Proportion of Tools Req'd		Cubic Feet of Excavation per Man		
	Picks	Shovels	1 hr.	4 hrs.	8 hrs.
Very hard...	2	1	15	40	67
Average ....	1	1	22.5	60	100
Light .....	1	2	30	80	133

TABLE II.

Hours required to complete 3½ foot and 5 foot tasks; or if not completed, per cent finished in 8 hours.

Nature of Soil	Type «A» Unrevetted						Type «B» Revetted					
	Fire Trench			Communication Trench			Fire and Communi- cation Trench					
	One Relief	Two Reliefs	One Relief	Two Reliefs	One Relief	Two Reliefs	One Relief	Two Reliefs	One Relief	Two Reliefs	One Relief	Two Reliefs
	3½'   5'	3½'   5'	3½'   5'	3½'   5'	3½'   5'	3½'   5'	3½'   5'	3½'   5'	3½'   5'	3½'   5'	3½'   5'	3½'   5'
Very hard....	90%	60%	5.5	7.25	7.0	80%	4.0	5.75	70%	50%	6.75	85%
Average ....	5.25	8.0	3.5	5.0	4.0	6.5	2.75	4.0	7.5	70%	4.5	6.5
Light .....	3.5	5.75	2.5	3.5	3.0	4.5	2.0	3.0	5.25	90%	3.5	5.0

#### MACHINE GUN EMPLACEMENTS.

32. Machine gunners should themselves be able rapidly to construct machine gun emplacements during an engagement (Figures 34, 35 and 36).

They may also be called upon to construct machine gun emplacements in the open ground as well as emplacements at certain points of parallels or approach trenches. These emplacements should be *carefully camouflaged from the beginning of the construction.*

#### Chapter II.

##### CAVE SHELTERS.

33. Cave shelters are dugouts constructed by tunneling operations (driving inclines, galleries and digging out chambers), having a roof of natural earth. They may be of various designs, depending upon the requirements and their use.

34. The timbering of the inclines and the galleries consists of standard sets placed side by side. The timbering of the chambers consists of top and side lagging (2 inch lumber), supported at regular intervals by chamber sets. (Figure 37.)

##### CAVE SHELTER SETS.

The timbering of a chamber or gallery consists of spaced sets supporting top and side lagging, which distributes the load to the sets and also prevents earth and rock from falling into the chambers.

Incline and gallery sets are made up of a sill, two posts and a cap. The center of the sills and caps are marked by light

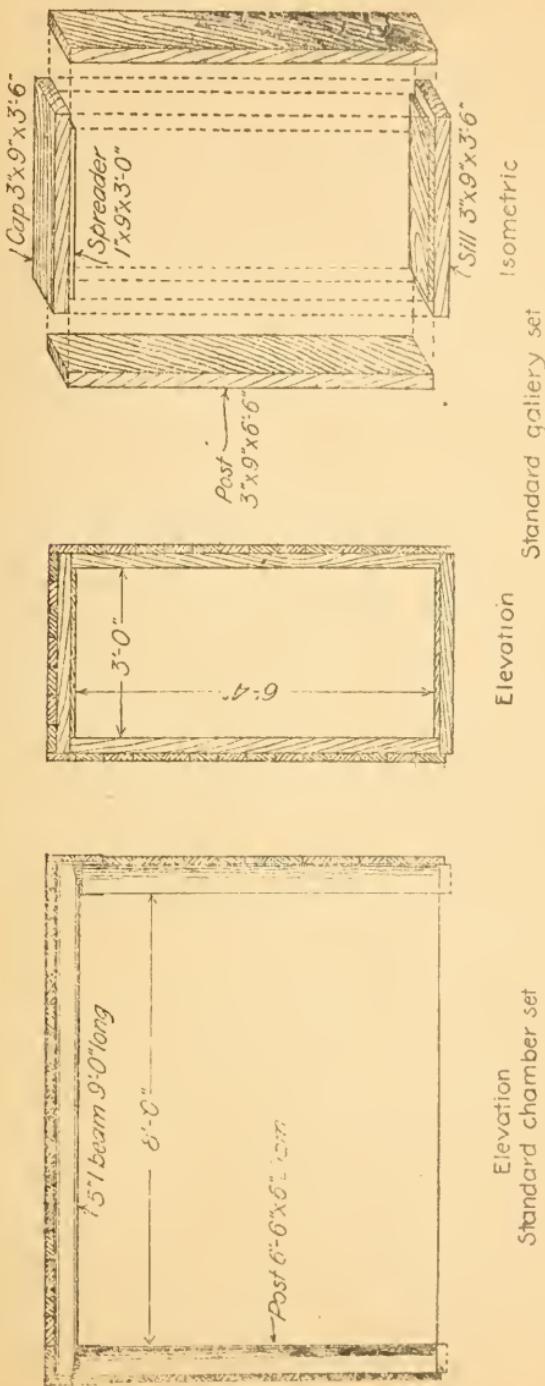


Figure 37.

saw cuts or grooves to facilitate placing the frame in position and verifying its alignment.

35. The spacing is the distance from center to center of two consecutive sets. *The maximum allowable spacing* is 3 feet. This distance is often made shorter, especially in the construction of horizontal entrances and in chambers where additional strength of timbering is made necessary by insufficient overhead protection.

36. Incline and gallery sets are placed one beside the other when the strongest possible support for the ground is desired. Chamber sets are sometimes placed side by side, and in this case no lagging is necessary.

37. Infantry should be able to construct inclines, galleries and chambers, using the following standard materials:

Although the materials listed below have been adopted for use by the A. E. F., French materials may sometimes be furnished and will be used in a similar manner.

*Incline and gallery sets*, inside dimensions 6' 4" high by 3' wide and made of 3" x 9" rough sawn lumber. (See Figure 37.)

*Chamber sets*, approximate inside dimensions 6' 4" high and 8' wide. Posts are of round seasoned timber having a minimum diameter of 8" and 6' 6" long. The caps are 5" I-beams, 9' in length.

*Lagging*. 1½" to 2" rough lumber 4' in length.

*Beam shoe*, wrought iron brackets shaped to fit I-beams, with a flat surface to fit the top of the post. They secure I-beams to post and prevent pressure pushing the posts inward.

*Miscellaneous*. In addition, material such as wedges, blocking, corrugated iron sheets, wire nails, 2" planking and heavy timber for bracing are necessary.

*Tools*. The tools required are picks, shovels, sandbags, a template for entrances, a spirit level for leveling caps, steel wedges, a heavy hammer and hand axe.

Two shovels, 1 pick and axe must at all times be kept in every dugout chamber.

38. The work will include the excavation (digging and removing of material); the erection of the set, and placing the lagging.

39. The sets must be strengthened by heavy longitudinal bracing. This ties together and strengthens the timbering in order to make it sufficiently rigid to resist the shock of high explosives. Especial care should be taken that the bracing be done in a thorough manner.

*Longitudinal bracing (sprags)* of heavy timber must be wedged tightly between the tops of sets and must bear on both posts and caps. Sprags must be placed at the bottom of posts where there is a tendency for the post to move in soft ground. In this case foot blocks (approximately 3" x 9" x 15") should be sunk into the floor as bearings for the posts.

40. The minimum depth of cover must in all cases be 25 feet where the underground water conditions permit.

41. All infantry units should be able to build cave shelters. The four mechanics in the company or pioneers of the pioneer platoon of the headquarters company act as instructors for the more difficult parts of the work.

All these pioneers are given complete instruction by the pioneer officers of the regiment.

The Engineer troops may be called upon to build observation shelters, or make periscope and ventilation holes.

42. Figures 38 and 38a show a cave shelter of standard dimensions. The entrance to the dugout is by an incline with sets placed vertically. The method of placing the timbers in inclines and galleries is the same.

The following are requisites for good construction:

*Cover.* A minimum depth of 25 feet of natural earth, or of 15 feet of hard rock to give protection against direct hits of 210 mm. shells; 30 feet against 305 and 380 mm. shells, and 50 feet against 420 mm. shells.

Artificial cover consisting of layers of rails, concrete beams, broken rock, bursters, etc., may be utilized when the natural cover is insufficient to give the desired protection.

A layer of logs 6 to 8 inches in diameter, well tied together and covered with a yard of tamped earth, offers the same resistance as one yard of natural earth.

*Inclines.* Cave shelters must have two entrances, which should be at least 40 feet apart and separated by a traverse to prevent the destruction of both by one shell.

*Entrances* should be placed 5 feet clear of traverses, and should have a minimum of 4 feet of head cover above the first set. Burster layers may be used to give added protection, but layers of rails, I-beams, concrete beams, etc., must not be used in close proximity to entrances, as they block them if hit.

A third entrance leading to open ground or dummy shell hole should always be constructed when the time permits. (Figure 39.)

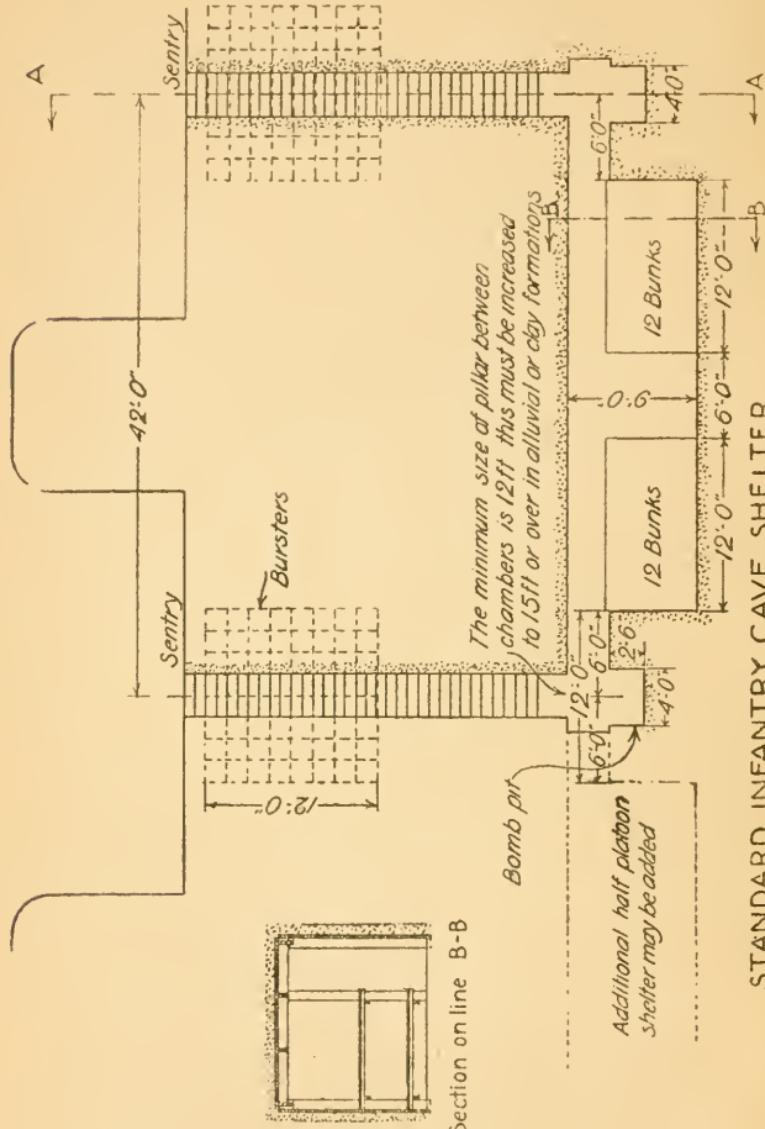
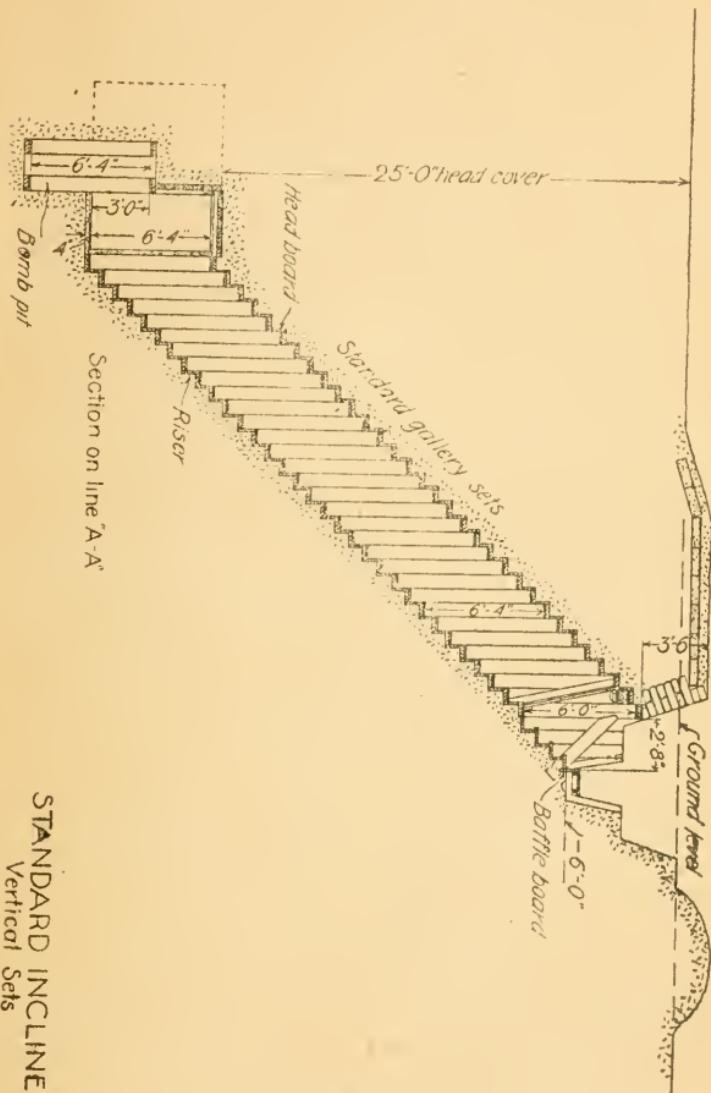


Figure 38.



STANDARD INCLINE  
Vertical Sets

Figure 38-A.

Inclines must be constructed at a slope of one to one ( $45^{\circ}$ ), except where the topography, such as the side of a sunken road, permits the construction of a horizontal entrance.

All entrances should be prepared for close defense. A sentry must be maintained in-front of each entrance at all times when the shelter is occupied.

The incline must be equipped with gas curtains (see Defensive Measures Against Gas Attacks).

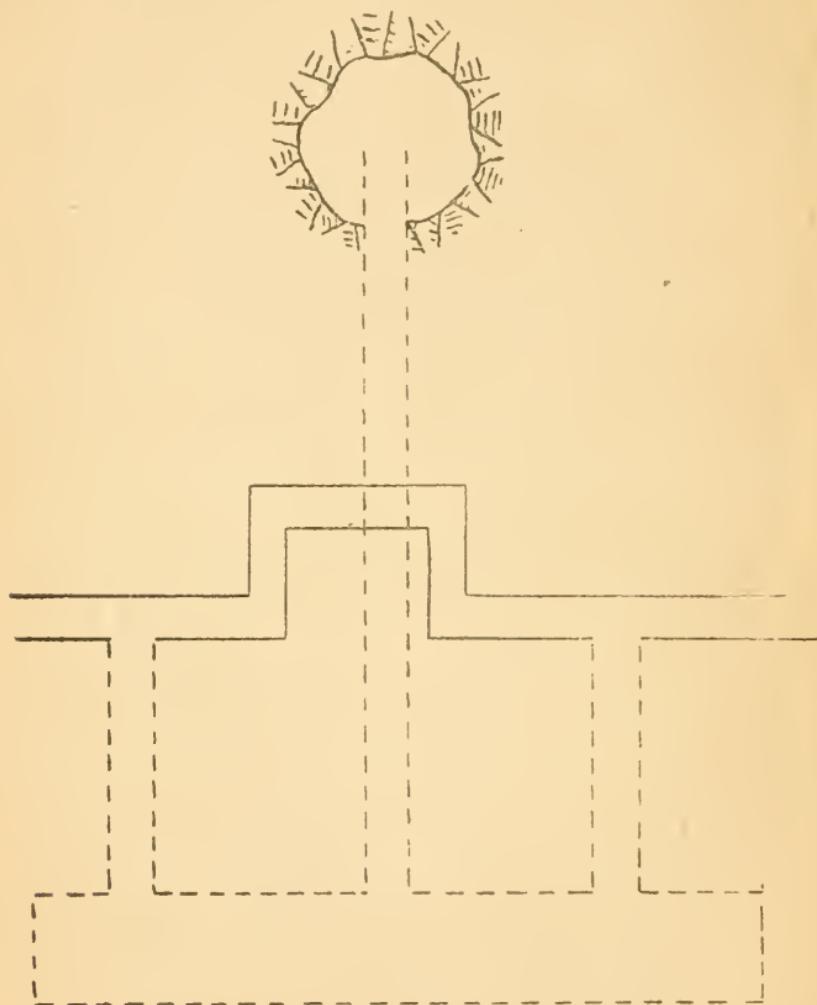


Fig. 39

*Spacing of sets.* Inclines or gallery sets must be placed side by side.

Chamber sets or French gallery sets must not be spaced over 3 feet. A closer spacing is often required, depending on the depth of overhead protection and the nature of the ground.

43. *Personnel necessary to construct a shelter.* Work should be begun simultaneously on each incline. The labor should be arranged so that the work will be carried on progressively by a crew of three working parties for each incline. Each working party works eight hours at a shift, or six hours at a shift. Each working party should consist of approximately ten men.

Non-commissioned officers in charge, 1 sergeant.

Miners, carpenters, helpers, 4 privates.

Fatigue labor for removing the soil, 4 to 6 privates, depending upon the length of the carry.

Thirty men, therefore, work on each incline, or a total of 60 for a cave shelter not counting additional carrying parties.

Time: In ordinary ground, 60 men should build a cave shelter for half a platoon in about 15 days.

### Chapter III. WIRE ENTANGLEMENTS.

44. Instructions on wire entanglements are given in Wire Entanglements Addendum No. 1 to Engineer Field Manual. The importance of constructing wire entanglements hurriedly has led to the introduction of drills for their construction. Officers, non-commissioned officers and men must be trained in those drills.

### Chapter IV. ACCESSORIES OF FIRE TRENCHES AND COMMUNICATION TRENCHES.

#### I—REVENTMENT.

45. Revetment is any artificial means provided to cause earth to stand at a slope steeper than it would naturally assume.

46. It is used extensively in the construction of parapets, trenches, and other field works, although its too extensive application is *objectionable* due to the great amount of time, labor and material required, and can often be *avoided* by widening and sloping to a safe angle the sides of existing trenches as well as by the provisions of berms or shelves at various levels (see Figures 15, 18 and 19 for trench profiles requiring little revetting).

47. The *main principles* in revetting trenches is to revet only the lower two or three feet. This is seldom injured by the enemy's fire and marks the bottom of the trench when it is to be cleared. Higher revetting requires more time, labor and material, and will almost certainly block the trench if

damaged by shell fire. It should be used only to repair injuries to the trench.

48. The *best method* of revetting trenches is:

(a) Use standard A frames placed 3 feet center to center supporting sheets of corrugated iron, expanding metal, planks or brushwood. (Figure 40.)

(b) If A frames are not available and the soil permits, the revetment may be supported by means of pickets driven into the bottom of the trench and braced as shown in Figure 41.

(c) The sides of the trench above this revetment should be cut to a slope of about 3/1 leaving a berm of 18 inches on each side at the foot of the unrevetted slopes.

49. The order in which the revetment of trenches should be undertaken is as follows:

(a) Revet the *fire step* and the interior slope of the *parapet* in fire trenches.

(b) Revet the lower two or three feet in communication trenches.

(c) Complete the revetment of the front slope and lower two or three feet of fire trenches.

50. There are two general *types* of revetments:

(a) The *retaining wall* type, which is self-supporting and is best suited to *fills*.

(b) The *superficial* type, which must have independent supports and is best suited to *cuts*.

#### RETAINING WALL TYPES.

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51. As these must be self supporting they should always take the form of a properly built retaining wall, i. e., the thickness at any level should be at least one-half the remaining height, and the average thickness not less than one-third of the total height.

52. *Sandbag revetment* is easily and quickly constructed, gives no splinters from shelling, and is especially useful for emergency work, for repairs, and for crowning. The bags, however, rot in three or four months, and this type should therefore be used mainly for temporary work. In laying sandbags, attention should be paid to the following points, some of which are illustrated in Figures 45 and 46.

Figure 40.

Field Fortification 2  
"A" Frames

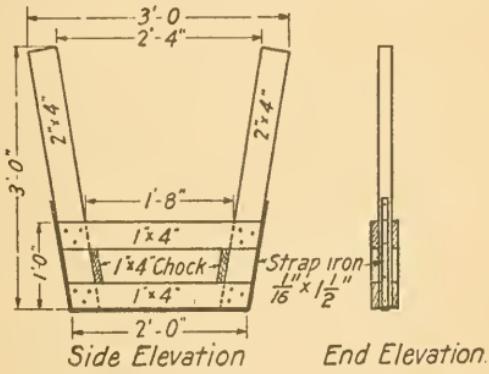
AMERICAN EXPEDITIONARY FORCES.

## ENGINEER FIELD NOTES NO 3.

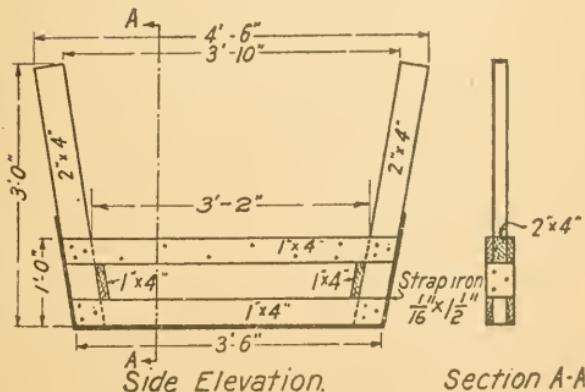
### FIELD FORTIFICATION NO 2.

#### STANDARD "A" FRAMES.

(Furnished by Engr Dept., for revetting, spaced 3' C to C.)



#### STANDARD 'A' FRAME.



#### SPECIAL "A" FRAME.

(For use in C.T. Type C)

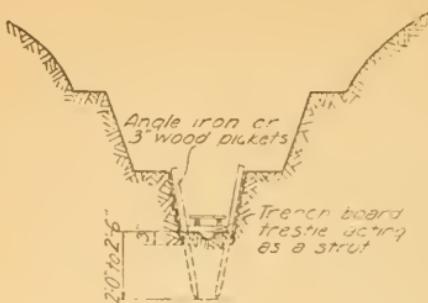


FIG. 41  
BRACED REVETTING PICKETS



FIG. 42  
SANDBAG REVETMENT  
REINFORCED

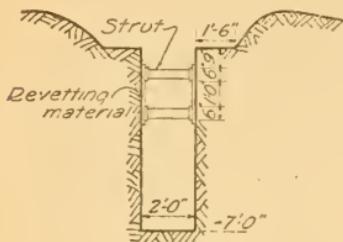


FIG. 43  
SHELL SLIT

1" Planking of trench boards omitted in order to show how stringers are placed.

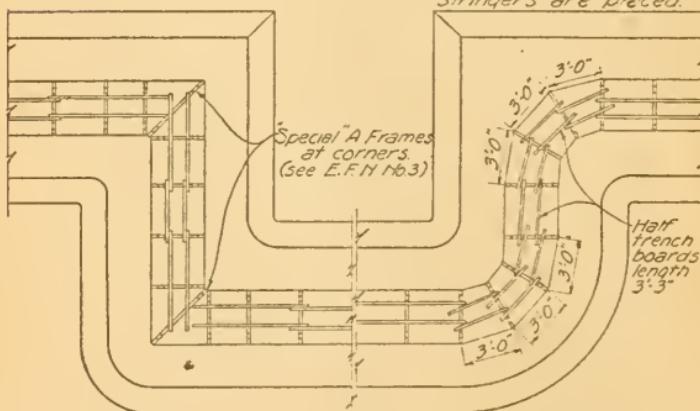


FIG. 64  
TWO METHODS OF PLACING A FRAMES AROUND  
CORNERS OF TRAVERSED TRENCH

- (a) Tuck in bottom corners of bags before filling.
- (b) Fill bags uniformly about three-quarters full.
- (c) Build revetment at slope 4/1.

- (d) Lay bags with beds perpendicular to slope.
- (e) Lay bottom row headers on prepared bed, intermediate row alternating headers and stretchers, top row headers.
- (f) Lay bags with seams and choked ends inward.
- (g) Break joints and beat bags into a rectangular shape.

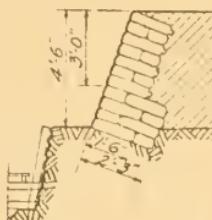
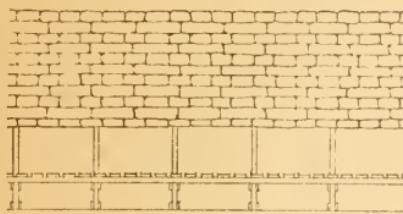
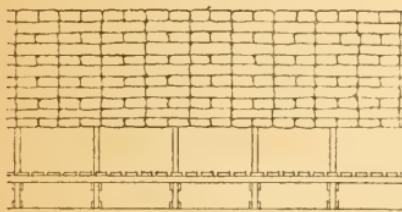
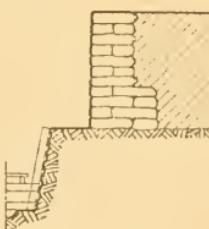


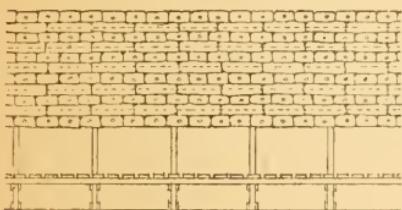
FIG 45  
SANDBAG REVETMENT CORRECT METHOD



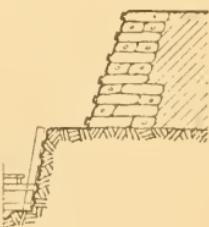
Joints not broken



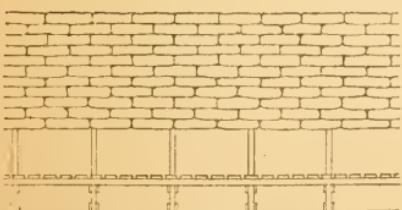
Face vertical



Seams and choked ends of bags outward



Bags not at right angle to slope.



All stretchers and no headers and insufficient base width

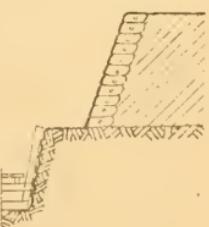


FIG. 46  
SANDBAG REVETMENT, INCORRECT METHODS.

(h) A sandbag revetment will last much longer if netting, preferably doubled, is placed over the face, as shown in Figure 42.

53. *Sod revetment* is more durable than sandbag revetment, and where sod can be obtained in sufficient quantity its use is recommended. Sods are cut 18 inches by 9 inches by 4 1-2 inches, laid grass down except top layer, and pinned together with wooden pegs. The principles c, d, e and g, given above for sandbag revetment, apply equally to sod revetment.

54. *Gabion revetment* is useful principally for revetting high fills, or for obtaining cover in flat and marshy ground (see page 328, Engineer Field Manual, for details of their construction and use).

55. *Stones and bricks* may be used for revetment in the form of retaining walls laid dry, in which case a slope of not more than 4/1, heads at right angles to the face, and broken joints are especially important. Due to the danger from flying splinters in case a stone revetment is hit by a shell, its use is not recommended where other material is available. If used in a parapet, it should always be crowned with earth-filled sandbags.

#### SUPERFICIAL TYPES.

56. This form of revetment consists of two parts, the *revetting material* which retains the earth, and the *supports* which hold the revetting material in place. It is most useful in retaining the slopes of trenches, since practically no additional excavation is needed for the revetment itself.

57. The *revetting material* may consist of corrugated iron, planks, expanded metal, brushwood, wire netting, poles or other available material.

58. The *supports* may be:

(a) *Standard A frames* for use in the bottom third of the trench as described in Par. 48 above. Methods of placing these frames around corners in traversed trenches are shown in Figure 44.

(b) *Anchored revetting pickets* for use in revetting front slopes of fire trenches, or other special cases where high revetment is required.

*Revetting pickets* should be from 3 inches to 3 1-2 inches in diameter, straight, pointed at the small end, and driven into the ground from 1 to 1 1-2 feet.

*Anchor stakes* should be driven firmly into solid ground 8 to 10 feet from the edge of the trench, staggered so as to avoid a plane of weakness parallel to the trench, and inclined so as to be perpendicular to the direction of pull on the anchorage wire.

*Anchorage wires* should pass at least 4 or 5 times between picket and stake. Each time take a round turn around the top

of picket or stake, and then tighten with a rack stick or windlass.

(c) *Unanchored revetting pickets* for use only with low revetments such as fire steps. They are supported by being driven from 2 to 2 1-2 feet into the ground and must always be braced at ground level as shown in Figure 41.

(d) *Struts* resting against opposite walls of the trench for use only in narrow deep trenches, such as shell slits (see Figure 43).

59. *In placing wire netting revetment*, the following should be noted:

(a) Cut vertical grooves in the slope at about 3-foot intervals to hold revetting pickets.

(b) Drive the two end pickets of each bay first and anchor them back loosely.

(c) Stretch a double thickness of wire netting taut between the two end pickets.

(d) Tighten anchor wires so that end pickets set back into their grooves.

(e) Drive remaining pickets and anchor them back so that they set into the grooves, thus drawing the wire netting tight against the surface to be revetted.

60. *In placing brush revetment*, the following should be noted:

(a) Brush should be clear of leaves, and is best about 3/4 inch in diameter.

(b) Pickets should be driven in first at about 3-foot intervals, leaving from 4 to 6 inches behind them for the brush.

(c) When brush has been built up to the top, pickets should be firmly anchored back, drawing the brush close against the slope to be revetted.

#### REVETTING MATERIAL.

61. The following material for revetment is carried in engineer dumps and can be obtained by requisition on the Division Engineer. The sizes given are standard, and should be used in requisitions, but the difficulties of supply will frequently necessitate substituting other sizes which will serve the purpose equally well:

(a) *Sandbags*: 12 1-2 inches by 25 inches, empty, in bundles of 50 with binders; when filled 3-4 full for revetment work each bag will weigh about 44 lbs., and fill a space 18 inches by 9 inches by 4 inches. At present depots have on hand sandbags 13 inches by 14 inches, empty, in bundles of 500; these bags have separate binders, weigh 65 lbs., filled, and will fill a space 20 inches by 13 inches by 5 inches in revetment.

(b) *Corrugated iron*: In sheets 2 feet 2 inches wide by 6, 7 or 8 feet long, of 22 to 26 gauge material, weighing from 1 1-2 to 1 lb. per square foot, respectively.

(c) *Expanded metal*: In sheets 2 1-4 feet by 8 feet, 3 feet by 4 feet, and 6 feet by 10 feet, half inch mesh, of 22 gauge material, weighing 1 1-3 lbs. per square foot.

- (d) *Metal lath and "hyrib"*: In sheets of various widths and usually in 6-foot lengths.
- (e) *Wire netting*: In rolls containing 150 lineal feet, 2 feet 8 inches wide, 3-4 inch mesh, No. 12 wire.
- (f) *Pickets*: 5 feet long, 3 to 3 1-2 inches in diameter.
- (g) *Stakes*: 2 feet 6 inches long by 2 to 2 1-2 inches in diameter.
- (h) *Angle iron pickets*: Made from 1 3-4 by 1 by 3-16 inch angles in two lengths 6 feet long, weighing 12.6 lbs. each, and 3 feet 8 inches long, weighing 7.7 lbs.
- (i) *A Frames*: In two sizes, "standard" and "special," as shown in Figure 40.
- (j) *Smooth wire*: No. 10 and 20 gauge, soft iron wire in 50 and 100 lb. coils.

## II—OBSERVATION POSTS.

62. *Lookout posts* are usually composed of niches dug in the interior slope of the trench and covered from the rear by a sandbag wall and on top by a fragment proof layer (boards or logs with a top layer of sand bags).

63. *The loopholes are reserved for the lookouts* for watching the enemy and for harassing fire (during combat, the men fire over the parapet). They are made of wood, sandbags, folding gabions (folding wooden frames), metal shields, etc., Figures 47, 48, 49, 50, 51, 52 and 53.

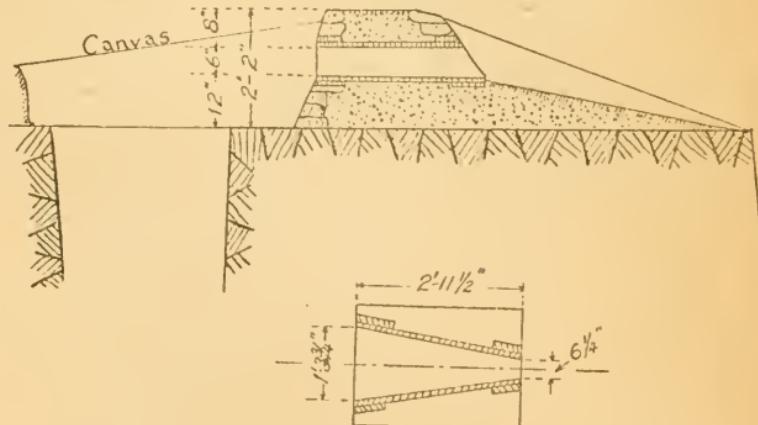


Fig. 47. Loophole of Wood

The exterior opening should be concealed by a cord trellis-work or other means that will nevertheless allow the barrel of the rifle to protrude.

It is essential that the enemy should not be able to distinguish whether the loophole is manned or not. With

in mind, the greatest care should be taken to prevent the hole from having the sky as a background or any wall

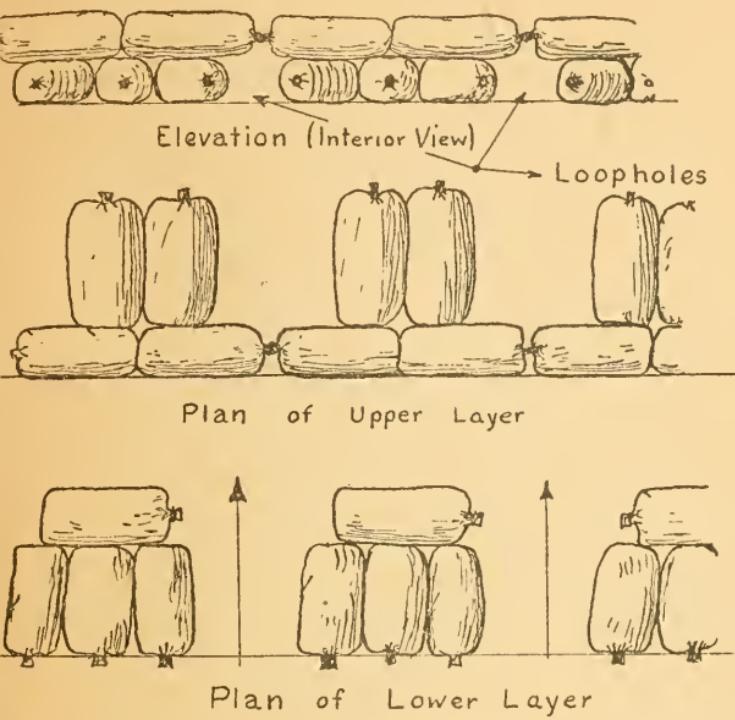


Fig. 48. Loopholes of Sandbags.

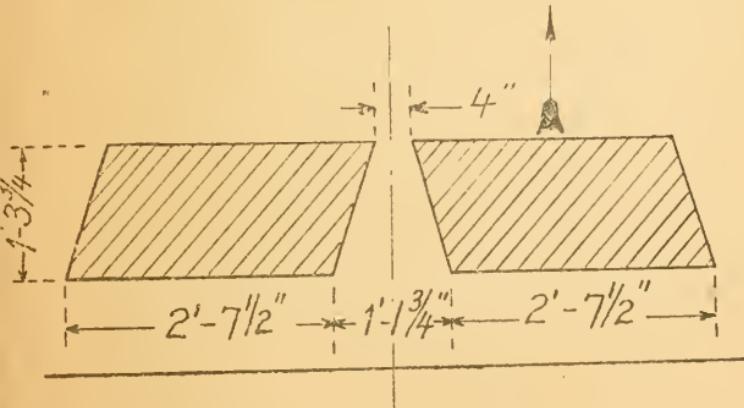


Fig. 49. Loophole of Folding Gabions

whose color contrasts with that of the trench. A cloth may be hung behind the head of the lookout to furnish the background.

Whenever possible, have the loophole oblique with respect to the enemy's trench; the lookout is better protected and the loophole is less visible.

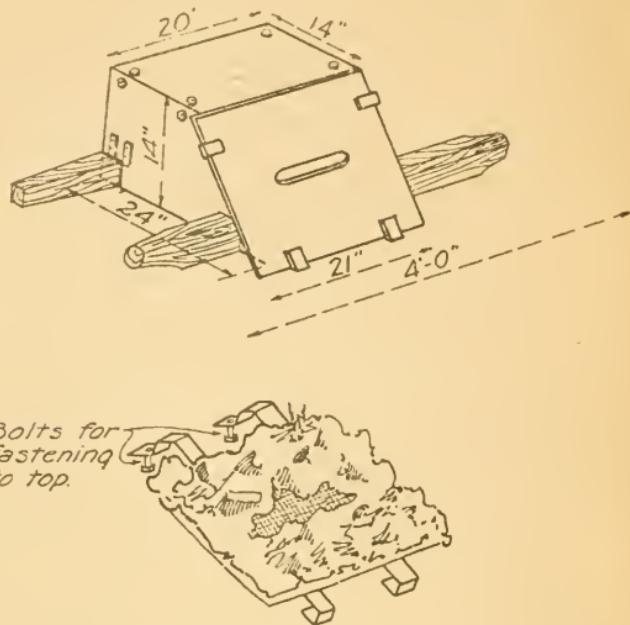


FIG. 50 PORTABLE ARMORED OBSERVATION POST.

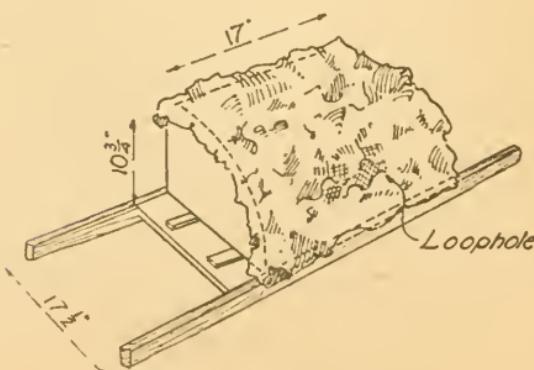


FIG. 51 ROLL TOP STEEL OBSERVATION POST.

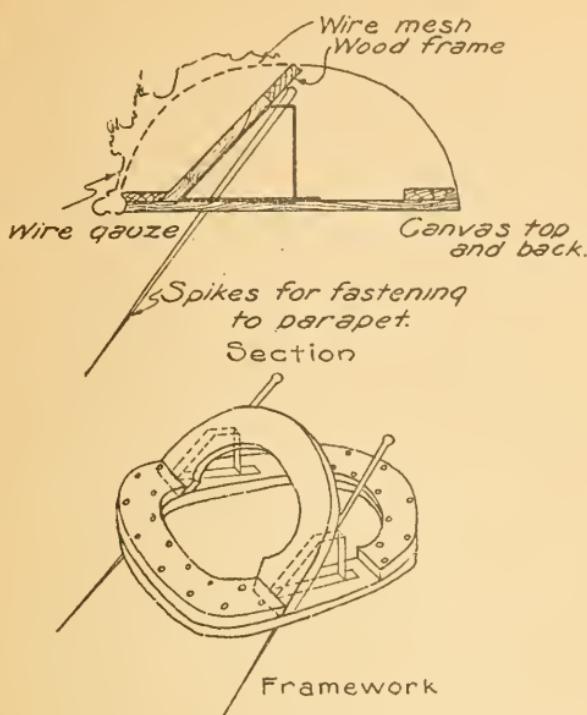


FIG. 52 UNARMORED BEEHIVE PORTABLE O.P.

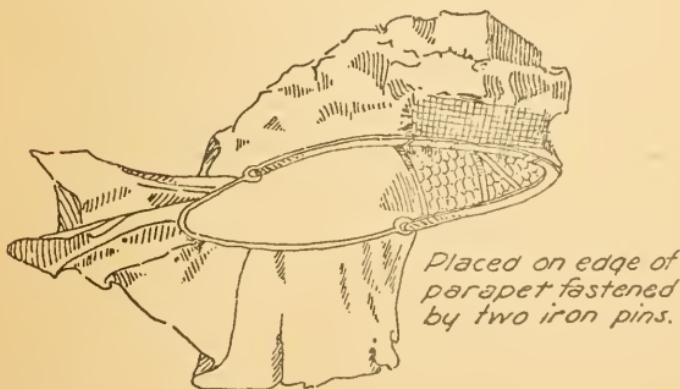
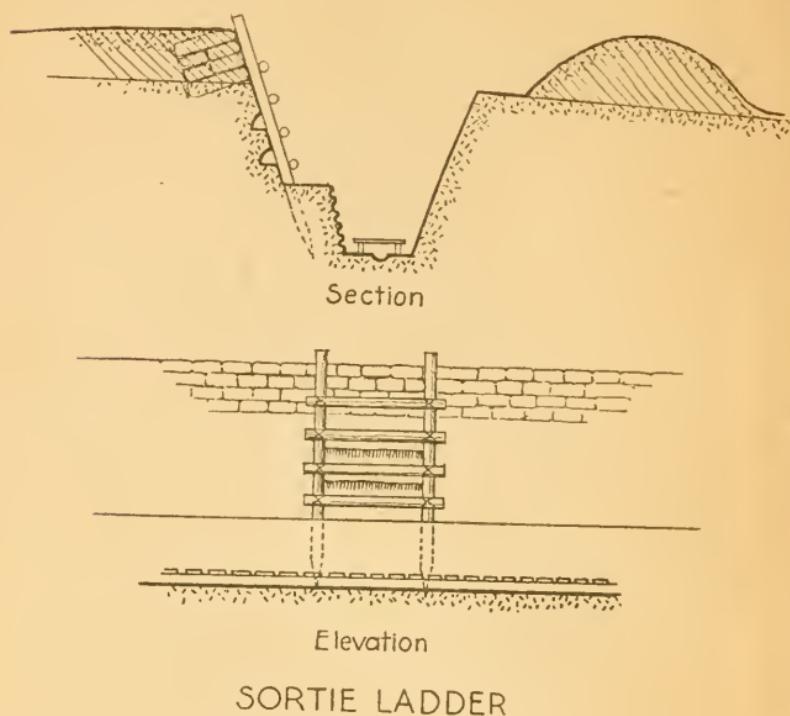


FIG. 53 UNARMORED DOME O.P.

## III—SORTIE ARRANGEMENTS.

FIGURE 54.



SORTIE LADDER

## IV—DRAINAGE.

64. The purpose of drains is to carry the water to the low points of the ground. (Take care that the water drawn off the drain does not flood other parts of parallels or approaches.) This is the best method for draining off the water when the ground has a considerable slope.

In ground that is not very sloping, *pits* are dug (Figure 58) at convenient intervals along the parallels and approaches and at low points. These pits are sunk to the permeable layers of the ground when possible. The bottom of the pit is covered with broken stones to avoid flooding. When the pits are unable to carry off all the water, constant pumping must be resorted to by means of pumps, buckets, scoops, etc.

The water is carried off to the drains or pits by small grooves dug along the center of the parallel or approach trench under

the trench boards, or along the foot of the reverse slope in the parts organized as a firing trench.

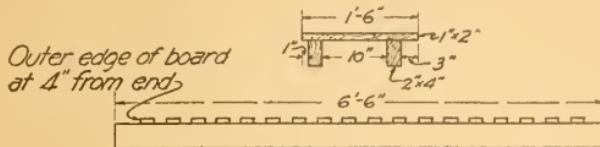


Fig. 55.

## Trench board.

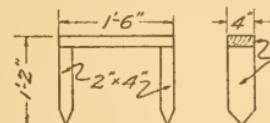


Fig. 56.

## Trench board trestle.



Fig. 57.

## Trench without flooring.

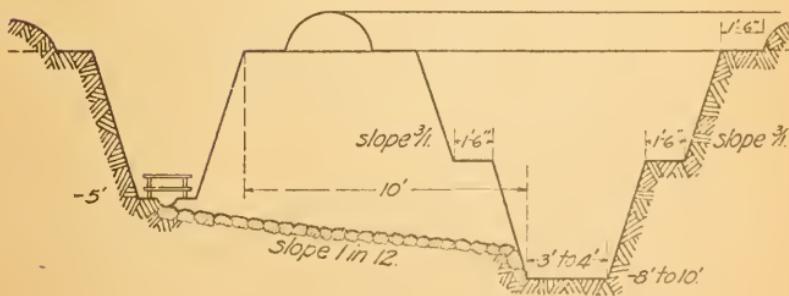
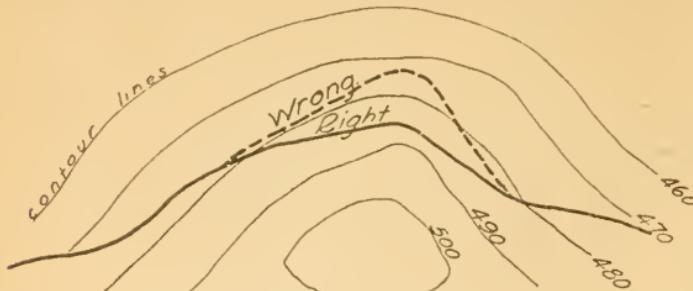


Fig. 58.

## Offset Sump.

65. It is almost necessary to cover the bottom of the parallels and approach trenches with trench boards ("duck boards")



Siting trenches to eliminate low spots.

Fig. 59.

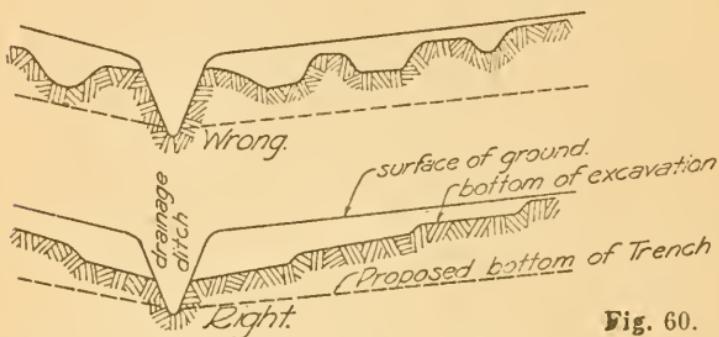


Fig. 60.

Longitudinal section of Trench under construction.  
(Showing manner of excavating Trenches so as to insure proper drainage.)

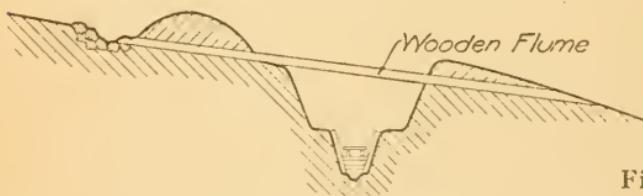


Fig. 61.

Surface water carried over the Trench.

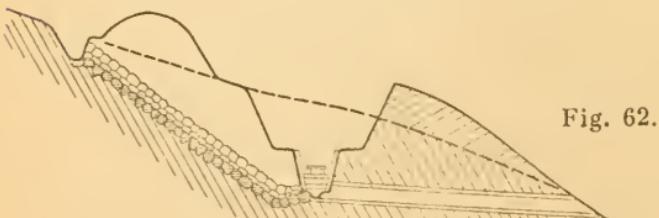


Fig. 62.

Surface water carried under the Trench.

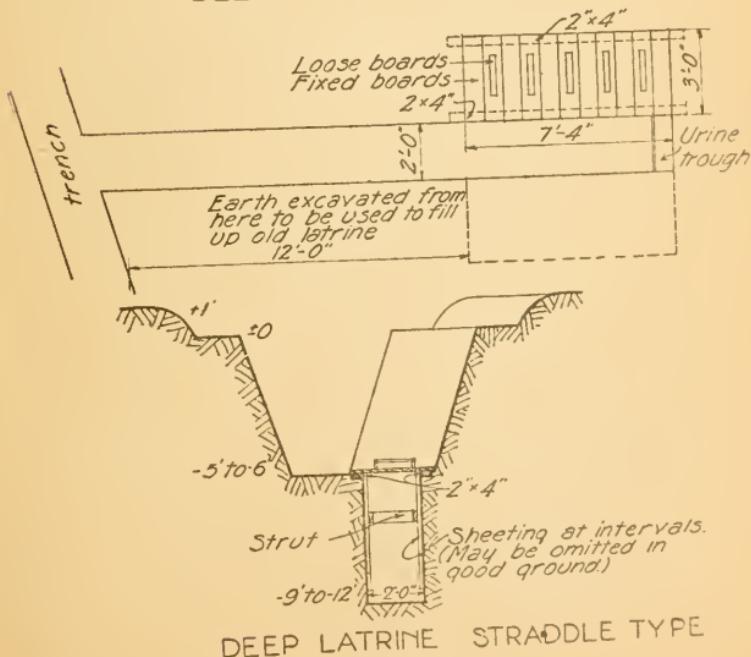
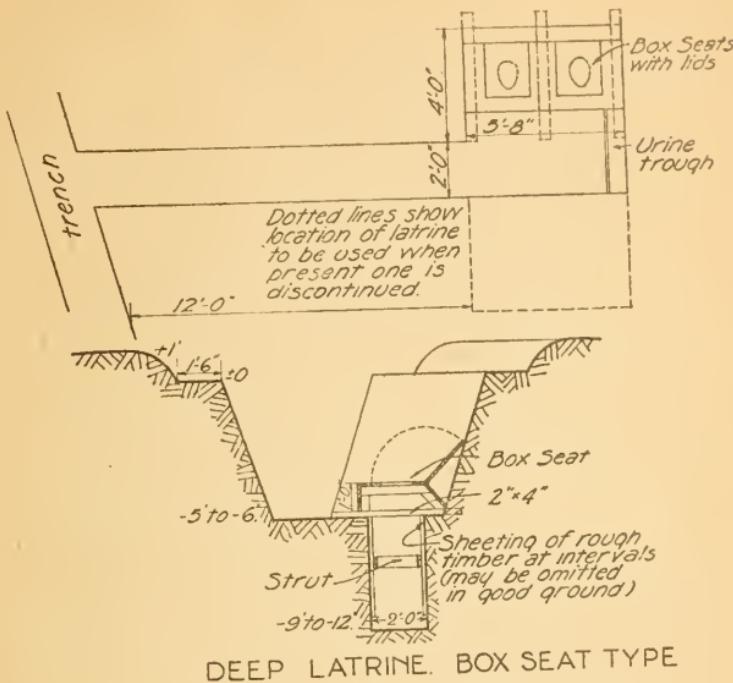


Figure 63.

(see Figures 55 and 56) in order to maintain circulation in all kinds of weather. Level the bottom of the trench well so that the trench boards do not move when walked on. When necessary, elevate the trench boards by having them rest on the ends of logs or planks.

In very hard earth, trench boards may at times not be necessary and a crowning of the floor of the trench may suffice, as in Figure 57. Figures 59 to 62 show other phases of trench drainage.

66. Figure 63 shows a latrine; Figure 64 a diagram of a portion of a front line, support line and communication trench. Figure 65 shows some types of traces of small works for all around fire. Figure 66 shows a type of splinter-proof shelter.

**DIAGRAMMATIC SKETCH OF PORTION OF FRONT LINE AND SUPPORT LINE WITH COMMUNICATION TRENCH  
(Advanced Posts and Wiring omitted)**

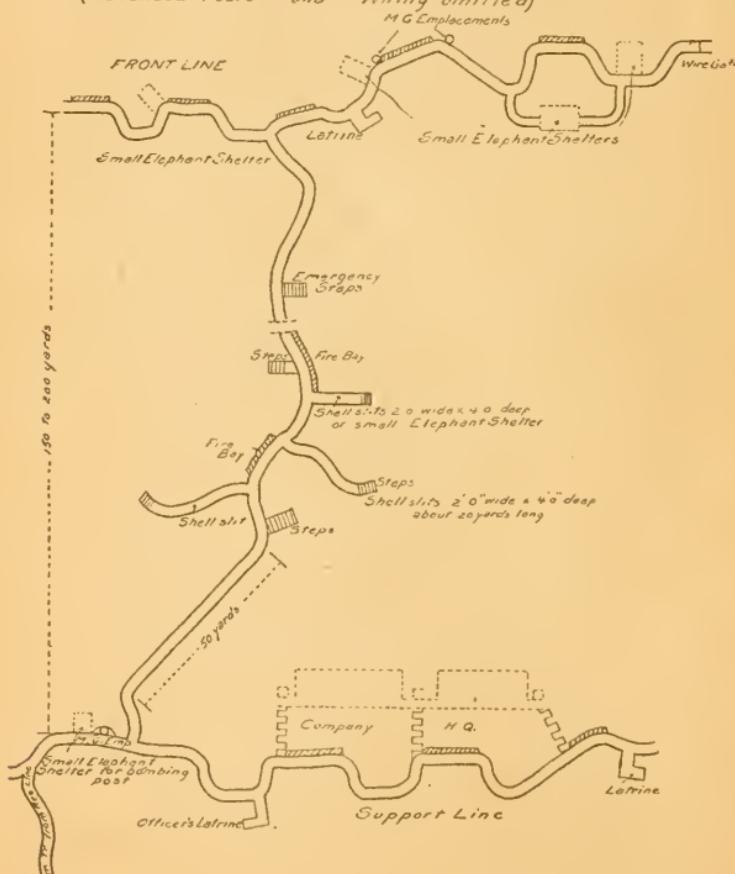


Fig 64

### TYPES OF SMALL WORKS FOR ALLAROUND FIRE

#### ELEMENTARY FORMS

By making fire steps on both sides of the trench as necessary,  
all around fire can be secured

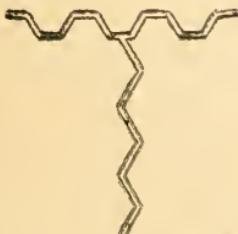


Fig. 65

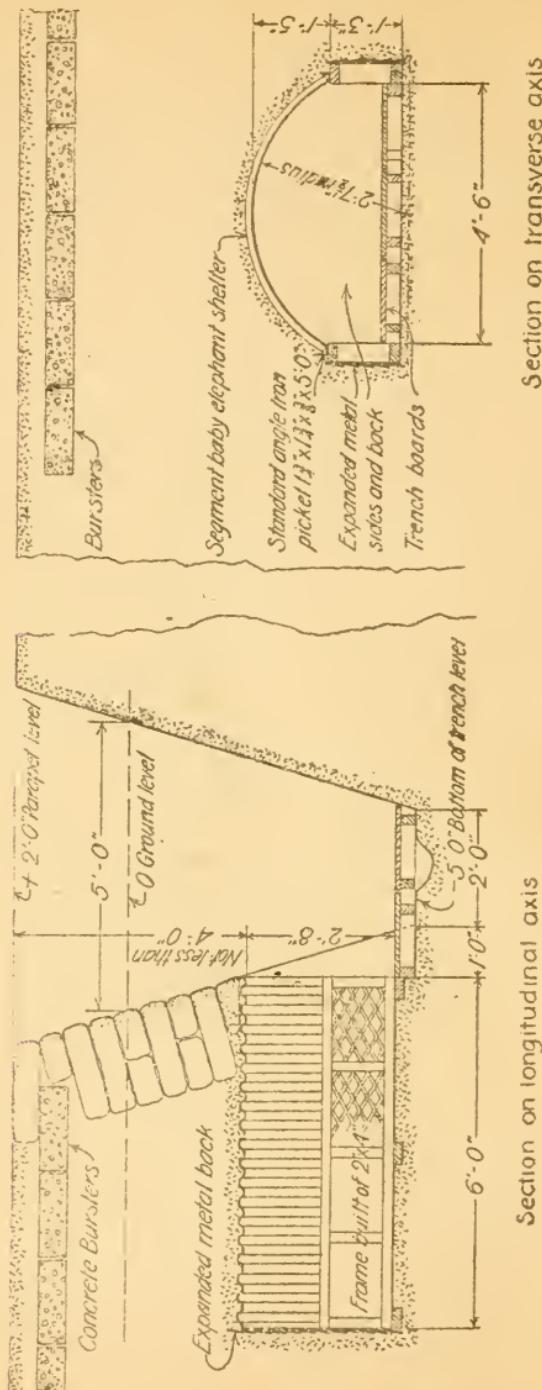
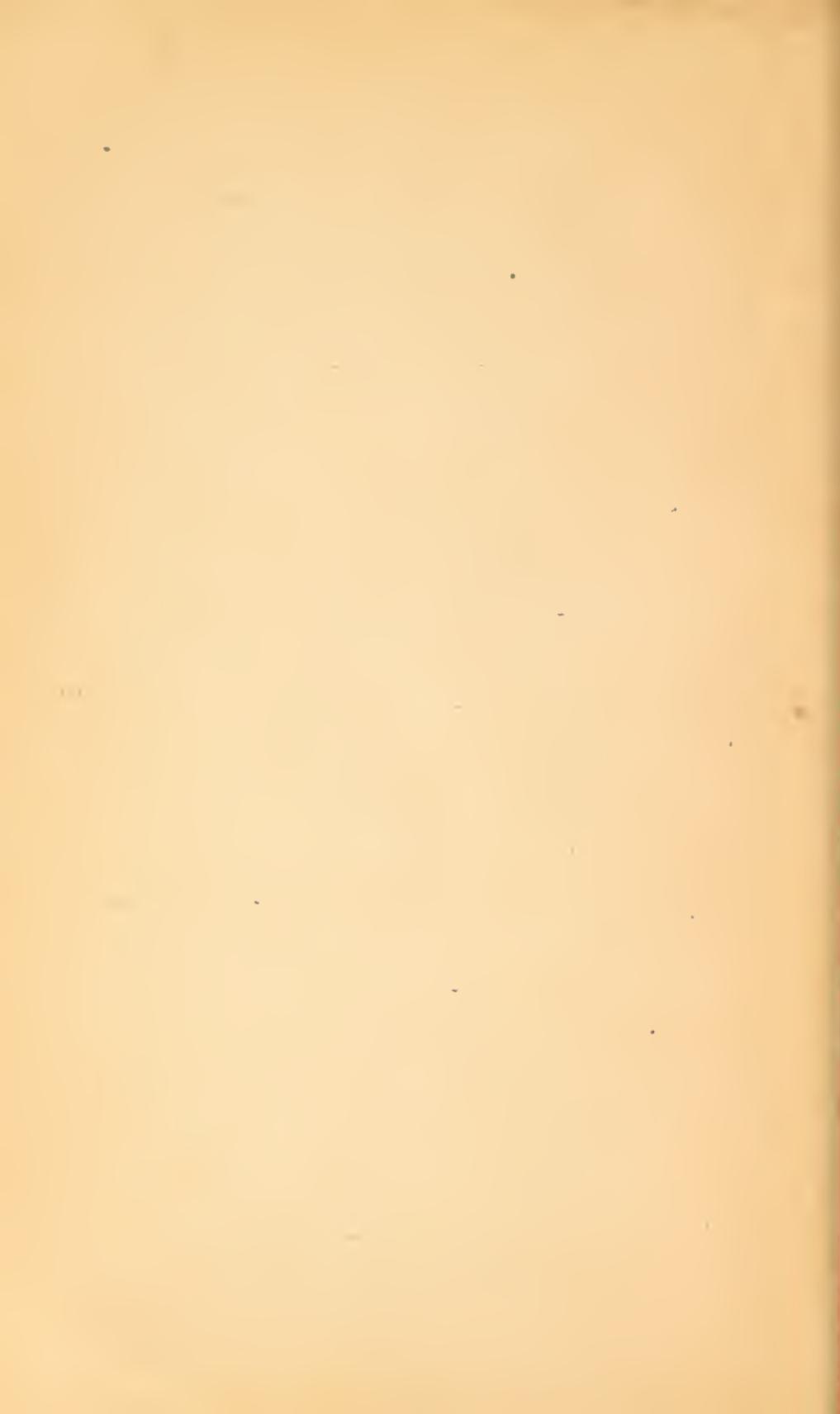


Figure 66.















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